VOLVME VI SEPT. 1897 No. 9

THE BRICKBVILDER

OFFICE 85 WATER STREET BOSTON

THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

PUBLISHED BY

ROGERS & MANSON,

CUSHING BUILDING, 85 WATER STREET, BOSTON.

P. O. BOX 3282.

Subscription price, mailed flat to subscribers in the United States and Canada	$2.50 per year
Single numbers	25 cents
To countries in the Postal Union	$3.50 per year

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Entered at the Boston, Mass., Post Office as Second Class Mail Matter, March 12, 1892.

THE BRICKBUILDER is for sale by all Newsdealers in the United States and Canada. Trade Supplied by the American News Co. and its branches.

PUBLISHERS' STATEMENT.

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THE BRICKBUILDER is published the 20th of each month.

THE REASONABLE PRINCIPLES OF ARCHITECTURAL COMPETITION.

THERE are four issues of primary importance which must be considered in defining a good architectural competition. The first point is the legal validity of the contract between the competing architects and the owner. Second, the financial considerations of this contract. Third, the considerations other than those purely financial. Fourth, the clear subordination of either the cost to the accommodation, or the accommodation to the cost.

FIRST: THE COMPETITION AGREEMENT SHOULD BE A DOCUMENT VALID IN THE COURTS.

We recognize two distinct kinds of architectural competition: limited competitions, in which the owner invites a limited number of architects to compete; and open competitions, in which all architects are free to enter at their own option.

These two sorts of competition may be variously combined or modified; but whatever form a competition may take, the relation existing between competitors and owner is first, last, and always a *business* relation. Its purpose is an exchange of goods or services to the profit of both parties. It is not profitable to an owner if a competition results in furnishing him with a lot of plans of no real service to him, nor is it profitable to architects to run this part of their business at an average loss. *Only those forms of competition are profitable which rest upon a sound business basis, and which bring an equal benefit to both sides.* This being granted, it follows that these benefits should be legally assured to both parties to the contract.

Important competition agreements should be tentatively drawn and submitted to the inspection of legal council on both sides; and especially should architects refrain from accepting such agreements until the documents have received such scrutiny. This reform must be effected through the machinery of their professional organizations.

The competition agreement or contract cannot be valid unless, first, the parties issuing it are empowered by law to fulfil it in all respects; and second, unless it be so drawn as to leave no legal uncertainty as to its meaning. The more terse the document the better. The word "shall" should be regarded with the highest suspicion.

SECOND: THE FINANCIAL CONSIDERATIONS OF THE COMPETITION AGREEMENT.

If an architect conducts his office with reasonable economy, he should make as net profit about one half his gross receipts. The usual payment for services being 5 per cent. of the total cost of the building, any one piece of work would bring him on an average a profit of 2½ per cent. of its cost. When, therefore, the award of the commission to design and erect a certain building is the declared aim of a competition, this 2½ per cent. of its cost is the money prize for which architects compete.

Now, before architects can fix a price for their services for entering into competition, they must know whether this prize is assured to one of the competitors, or not. What is necessary is a definite statement which can be legally maintained one way or the other. In most cases where competitions are held the erection of a building has been definitely decided upon, and it is a very remote contingency that may prevent its erection. The only appreciable danger, therefore, in announcing the commission for the building as the prize of the competition is that no one of the competitors will prove a suitable person to design and erect it. This danger is absolutely avoided by having a limited competition to which only capable architects are invited; but, inasmuch as even with excellent competitors there is a remote possibility that something may cause the abandonment, or essential modification of the owner's intention, a mode of liquidating his indebtedness to the winning architect should be provided in the competition contract, and this, of course, would be the payment to the winning architect of 2½ per cent. on the proposed cost of the building, the money equivalent of the commission.

If, then, a competition agreement guarantees the prize of the competition to be the award of the building or the payment of 2½ per cent. of its proposed cost, the architect has a definite business proposition upon which to base the price of his services. Whether this price be low or high will next depend largely upon the following considerations.

An architect's chance of winning a competition depends, first of all, upon his ability, and second, upon the number of contestants in the competition. Exceptional ability always has its premiums, and is exempt from ordinary rules; but the great majority which constitutes the average man must recognize their force and conform to them. They must obey the law of averages, or violate them at their own risk.

Now, suppose a competition to which five men are invited. By the law of averages each man has but one chance in five of winning that competition, and in a round of five such competitions he stands

to lose four times and win once. As we found above, the net profit of a $300,000 building is 2½ per cent. on its cost, or, $7,500. This is clear gain. In competitions of five contestants for such a building each architect therefore stands to win $7,500, minus the loss to him of preparing four different sets of unused sketches. The normal value of each of these sets of sketches is 1 per cent., or $3,000, according to the schedule of the American Institute of Architects. Half of this amount is reckoned as the cost of the drawings, half as profit. *Profit, however, is only another name for the payment made to the architect for his own individual services.* The profit for a year represents what he personally earns in a year, just as the laborer's income is the sum of his total wages. If the laborer did his day's work and was denied payment for it, his case would be the same as that of the architect who made competition sketches and was paid only the "cost" of them. The architect loses as clearly in that case as the laborer when his day's wages are withheld.

Accordingly, if an architect, acting upon the suggestion of certain leading members of his profession in New York, decides that otherwise proper competitions may be accepted when payment of cost alone is made for sketches, he is then doing that work at the loss of his own individual wages, which, in the instance taken, amount to $1,500. His total losses in a round of five competitions would be four times $1,500, or $6,000. His total winning, the profit of the full commission for the building, would be $7,500. This, therefore, leaves him a saving of $1,500, *or one half of 1 per cent. on the cost of the building, as his entire profit on work which normally brings a profit of 4½ per cent.;* namely, four different sets of competition sketches at 1 per cent. each and one full commission at 5 per cent. This, clearly, is a very narrow margin of profit, yet it is sufficient to permit us technically to define a competition on this basis as profitable.

When, however, the number of contestants varies from that taken in the previous example, different results are found. In competitions of ten contestants the architect stands to lose nine times and win once. Computing as above, his losses in ten such competitions would be nine times $1,500, or $13,500, while his one winning brings him in but $7,500, making a total loss of $6,000 if he should enter ten such competitions.

Equally, when the move is in the other direction and the number of contestants is lessened, the architect stands to increase his margin of profit. In competitions of only two, where each contestant should win one effort in two, the loss would be only $1,500, to a gain of $7,500, leaving a profit of $6,000 on a round of two competitions.

The following is a summary of what each architect stands to win or lose in competitions comprising up to ten competitors for a $300,000 building, when the commission, or an equivalent payment, is guaranteed, and each competitor is paid one half of 1 per cent. as the cost of his competition sketches.

No. of competitors.	Each receives in one round of competitions.		Each loses in one round of competitions.		Difference between receipts and losses.		Number of competitions in one round.		Each stands to win or lose in each competition.
2	$7,500	minus	$1,500	equals	$6,000	divided by	2	equals	$3,000
3	7,500	"	3,000	"	4,500	"	3	"	1,500
4	7,500	"	4,500	"	3,000	"	4	"	750
5	7,500	"	6,000	"	1,500	"	5	"	300
6	7,500	"	7,500	"	0	"	6	"	0
7	7,500	"	9,000	"	—1,500	"	7	"	—214
8	7,500	"	10,500	"	—3,000	"	8	"	—375
9	7,500	"	12,000	"	—4,500	"	9	"	—500
10	7,500	"	13,500	"	—6,000	"	10	"	—600

The deductions from this investigation are of the greatest importance, and may be worked out by the owner and the architect as their interests impel them. Certainly it is very clear why it is the owner's interest to keep the number of contestants as small as possible, and to select only architects of the highest ability.

We are also prepared to understand why open competitions are not deemed profitable by architects; for if, as in the above example, a single limited competition of ten contestants with the award of the building guaranteed, and each competitor paid the cost of drawings, means an average loss of $600 to each of those who enter it, it is not reasonable to suppose that architects of standing and intelligence will enter competitions where the individual recompense is not assured at all, and where the number of contestants is entirely unlimited.

THIRD: CONSIDERATIONS OF THE COMPETITION AGREEMENT WHICH ARE OTHER THAN FINANCIAL.

All the advantage that an architect receives in entering into competition is not financial. Otherwise there would be no such discounting of the price of services as is now usual. His greatest inducement, after the financial one, is the ambition of every architect to erect important buildings. It makes a great difference, therefore, to an architect already in good practise, whether the erection of the building is assured or not. The chances of losing the building through the selection of one of the other competitors, when multiplied by the chances of the owner's withdrawing the building altogether, forms too great a hazard for him to consider in cases where the erection of the building is not guaranteed. Guaranteeing the erection of the building, therefore, presents an inducement over and above the merely monetary security it gives, and constitutes a consideration which owners cannot fail to regard.

Another consideration of the greatest importance is the assurance of just dealing between competitors. The knowledge of the owner's integrity and right of intention does not of itself offer this assurance. It is not the lack of right intentions that wrecks competitions, but the blunders of men unaccustomed to the task of directing them. Architectural competition is not at its best unless it is so conducted as to give free play to the contestants' spirit of emulation. In this respect it is like all sports which aim at the highest attainment of the individual. Such forms of emulative competition must be conducted under rules very different in nature from those which govern in the courts of law. The rules which govern the sports may often seem absurdly technical to the non-sportsman, yet they are evolved by long practise, and are essential to the moral health of the sports conducted under them, quite as much as the laws of our courts are essential to the social safety of the community; but the difference between them is a very essential one. The law of the courts obliges a plaintiff to prove his injury, as well as the facts alleged. The law of sports makes the fact and the injury identical. It is not necessary for a yacht to prove that she has been injured in a collision brought about through the fault of another boat to claim a foul and its penalty, nor need she show a loss if forced off her course improperly. The penalty attaches to the fact of interference, and the question of the amount of injury caused by that interference, or of intention, which forms so large an issue in the courts of law, is not considered. A blunder is a crime, and is punished as such.

Additional instances might be set forth at length, showing conclusively that in all those fields of competition where the highest perfection of individual attainment is sought, the law sanctioned by experience absolutely safeguards the interests of those who maintain the rules set down, and as absolutely condemns those who break them. The rules themselves thereby come to have an importance appreciated only by those who have watched their long application, and have learned their necessity. It matters not so much what the rules may be as that their integrity be maintained. Otherwise there is no assured freedom for any, and the best conditions to enthusiastic effort are lacking.

The rules which govern competitions should therefore be as few and as distinctly stated as possible, and the restraints imposed of a kind which leave free the best faculties of the competitor. The penalty for an infringement of these rules must be the instant, final, and unequivocal disbarment of the transgressor. These rules can only be drawn up by one who has devoted time and thought to the science of conducting architectural competitions.

Still another consideration valued by architects is the knowledge that their plans are to receive the judgment of one able to appreciate their finer shades of excellence, and a reasonable assurance that the opinion of such a judge will be an important factor in determining the award.

FOURTH: RELATIVE DEMANDS REGARDING COST AND ACCOMMODATIONS.

There is yet another most important consideration, which appears to have hitherto been very largely overlooked. We refer to the habit of stating in competition programs in an absolute way both the accommodations of the building, and its limit of cost. This arbitrary method defeats its own end. The architect is not omniscient, and cannot possibly arrive at any right estimate of what it will cost to meet the given conditions until his sketches are made, and the time for sending them in is close at hand. The competition cannot then be declared closed upon his representations and new instructions issued. It is too late. The drawings go in and disaster follows. All drawings are declared rejected because none fall within the limit of cost. Whose fault is it? It is hard to say.

Surely no architect should be so silly and no committee so fatuous as to believe that absolute statements of cost and absolute statements of accommodation, size, materials, etc., can be unchangeably determined before plans are made, *for it is precisely to determine the relation of these two things that the architect makes his drawings.*

If the cost must be absolutely limited, it will pay the owner to let the architects exercise their intelligence in adjusting his desires to his pocketbook; but if, as in most buildings, the accommodations demanded are in reality the essential thing, it is certainly enough to state with emphasis that economy in meeting these demands will form an important issue in determining the award.

ROBERT D. ANDREWS.

THE recent International Congress of Architects, which was held in connection with the Brussels Exposition during the past month, has awakened considerable interest on the part of architects in this country and abroad; and although America was represented by but four delegates, if we are properly informed, out of a total attendance of about three hundred, the eminence of those participating in the deliberations of the congress and the ideas which were developed in the discussions have combined to give it a peculiar value. It is to be hoped that these international congresses may become more frequent. No country can live to itself in art any more than in anything else, and in these days when architecture is so essentially a matter of convention, tradition, and concurrent practise, no one can afford to neglect an opportunity to compare his standards with those of other countries, nor to ignore the achievements of foreign architects. The object of this congress was avowedly to bring about a better understanding of the practise of architecture in the various countries and to awaken the public to a better appreciation of architecture, and although the duration was short, only five days, the program was a very full and complete one. The language of the congress was French. Great credit is due to the Société Centrale d'Architecture for the admirable manner in which the congress was organized, the cordial reception and careful consideration for the comfort and pleasures of the members of the congress, and to Mr. Dumortier for his strong and efficient management during the entire session. The congress was informally opened on Saturday, August 29, by the King of Belgium, in person, and the succeeding days were taken up with discussion of architectural topics in the mornings, and delightful excursions to surrounding points of architectural interest in the afternoon. Aside from the business transacted, the one thing which was most worthy of note was the individual character of the distinguished delegates and the high personal esteem with which they were held. There were present not only architects, but statesmen, three members of the Institute of France, one deputy, one member of the Italian parliament, and several French representatives, besides others in political and municipal affairs from many countries. That Leopold, King of the Belgians, should have come up from Ostend specially to open the congress is sufficient proof of the high esteem in which our profession is held in foreign countries.

It is to be hoped that the next congress of architects, which is to be held in connection with the International Exhibition in Paris, in 1900, may be more fully attended by our countrymen. The architectural efforts of America are hardly appreciated at all in Europe outside of England. While our architecture has not the past to boast of, which is so valuable a factor in European art, our progress during the past two decades has been along lines of which we have every reason to be proud, and in an international congress of this description our delegates ought to be able both to give and receive. We are indebted to Mr. G. O. Totten, Jr., the official delegate from the United States Government, for a very complete and interesting account of the congress.

IN this connection it is intensely gratifying in every respect to note the spirit which has accompanied the growth of the T Square Club at Philadelphia, which from being an association of young and extremely enthusiastic draughtsmen, has developed into one of the leading architectural bodies of the country, certainly being foremost in the enthusiasm which is so essential to continued interest in architecture as a profession. The club has repeatedly put itself on record in a most emphatic way as being keenly alive to its own possibilities and the general good of the profession, and its history ought to be an example to all the other clubs and architectural societies throughout the country as showing the lines in which club work can be carried along so as to profit not only the members themselves, but to form a tangible force in the advancement of art in general and architecture in particular. The T Square Club is full of live, energetic men, including among its members the best talent of the Quaker city, and by its action of sending a properly accredited delegate to the Brussels Congress of Architects, it has shown its appreciation of the position which a society of this kind can occupy in relation to its growth. We lack in this country very strongly what the French term *esprit de corps*, and architects are so constantly accused of professional jealousy, and unfortunately there is so often good reason for the charge, that we sincerely hope that the spirit of the T Square Club may spread beyond the borders of Philadelphia. Mr. Kelsey, the delegate of the club, gave a very felicitous address in which he summed up the position of the T Square Club as being pre-eminently one whose attitude was to seek and study, and every one who has had the pleasure of reading his words will feel that in this instance the profession as a whole, as well as the T Square Club, was honored by the Philadelphia delegate.

PERSONAL AND CLUB NEWS.

MESSRS. O. A. KLUMANN and Charles I. Thomas, Wilkes-Barre, Penn., have associated themselves under the firm name of Klumann & Thomas for the practise of architecture. Catalogues and samples desired.

THE Chicago Architectural Club had its first meeting after vacation, on Monday evening, September 13.

"How to Make the Most of the Club's Privileges this Coming Season" was the subject for discussion; many of the leading members offering valuable suggestions which will no doubt materialize as the season advances.

THE second annual exhibition of the Cleveland Architectural Club will be held in the New England Building, from Nov. 15 to Nov. 27, 1897.

Works will be received until Monday, November 1.

The exhibition will include: —

Architectural sketches, perspectives, and elevations in all renderings; photographs of executed work; landscape architecture; interior architecture and decoration; interior furnishings (samples and sketches); architectural and decorative metal work (wrought iron, bronze, and brass); carving and sculpture (wood, stone, metal, or plaster); advertisers' exhibit (the latest novelties and improvements for modern buildings).

All drawings for the exhibition must be framed or mounted.

The Cleveland Club will pay all charges for the collecting, shipping, and returning of contributed works.

At the first regular meeting held by the St. Louis Architectural Club after the vacation season, a general discussion of the proposed work for the winter brought out many interesting features, and considerable interest was manifest. All committees were instructed to bring in full reports at the next meeting, including a special committee which was appointed to look into the advisability of the club publishing the revised building ordinance.

Messrs. Bailey & Enders were appointed a committee to procure a suitable case for the medal which was awarded the "T" Square Club of Philadelphia some time ago, for the best club exhibit.

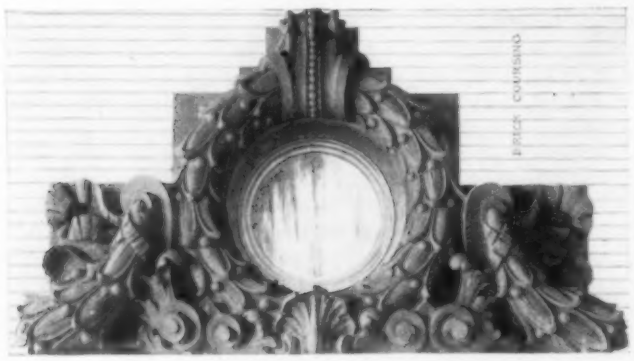
ILLUSTRATED ADVERTISEMENTS.

THE Excelsior Terra-Cotta Company illustrate, in their advertisement on page iv, the new Mechanics Bank Building, Brooklyn, N. Y.; George L. Morse, architect.

Fiske, Homes & Co. have illustrated on their advertising page (vii), number three of their new and especially prepared designs of brick and terra-cotta fireplace mantels.

On page viii, in the advertisement of the New Jersey Terra-cotta Company, is illustrated the new New Zealand Building, Broadway, New York City; Hoppin & Koen, architects.

A residence at Buffalo, N. Y., of which C. D. Swan was the



architect, is illustrated in the advertisement of the Harbison & Walker Company, on page xxv.

Two views of the Hall Memorial Chapel, Woodlawn, Chicago, W. A. Otis, architect, are shown in the advertisement of Charles T. Harris, Lessee, on page xxix.

The Gilbreth Seam-Face Granite Company, in their advertisement on page xxxviii, show a fireplace at Lenox, Mass., of which George T. Tilden was the architect.

PLATE ILLUSTRATIONS.

PLATES 73 and 74. Details of the upper stories of the Dun Building, now in course of erection on Broadway, corner of Reade Street, New York City; George Edward Harding & Gooch, architects.

The Broadway and Reade Street façades of this building are constructed of light brick and terra-cotta.

Plates 75 and 76. Details of the upper stories of the New Queen Insurance Company Building, Broadway, New York City; George Edward Harding & Gooch, architects. Like the Dun Building, this, too, is constructed of brick and terra cotta.

Plates 77, 78, 79, and 80. Dental Hall, University of Pennsylvania. The building, of which the exteriors and details only are given, is arranged in plan in two parallel parts connected by a staircase neck. The main portion is 50 ft. wide by 180 ft. long, the smaller wing is 48 by 85 ft.; these two are arranged on a central axis, and their difference in length accommodates itself to the lines of 33d Street and Locust Street, which intersect at an angle of about 50 degs. The larger building has its upper story devoted entirely to the operating room, in which are placed one hundred dental chairs. The back building contains an auditorium seating five hundred. The remainder of the floor space is given over to laboratories, examining rooms for patients, lecture rooms, students' assembly room, and quarters for the faculty and dean.

The structure is of slow-burning construction throughout with the exception of the roofs, where steel trusses are used. The heating is by steam and is supplemented by a special system of ventilation. Lighting throughout and power for operating the machinery of the laboratories is by electricity. These two are supplied from the main central heat and light station of the university. The exterior of the building is of brick laid in Flemish bond. The trimmings throughout are of terra-cotta, the roof of red tiles with cresting and lanterns of green copper.

THE legislature of Illinois having passed a law providing for the licensing of architects and the regulation of the practise of architecture, the governor has appointed the following named gentlemen to act on the Board of Examiners: Mr. Dankmar Adler, of Chicago, the president of the board; Mr. Peter B. Wight, of Chicago, the secretary; Mr. William Reeves, of Peoria; Prof. N. Clifford Ricker, of the University of Illinois; and Mr. William Zimmerman, of Chicago. The board has chosen a committee on examinations, consisting of the president, and secretary, and Mr. Reeves, and will soon be ready to enter upon the performance of its duties.

THE matter of licensing architects is receiving more or less serious consideration by the profession, and a committee of the institute has been appointed to investigate and report on the advisablity of adopting some such restriction. The most conservative opinion seems to be that the time has not yet arrived when such a plan could be carried out with sufficient thoroughness to be of any special value, either to the profession or the public. On the other hand, the fact remains that this matter is being agitated more or less by State and municipal governments, and that certain laws bearing on this question have been already passed in some places, which shows that within a comparatively short time the proposition must be met and settled in some way. Legislation affecting any profession should be controlled from within rather than from without, and while action may be temporarily deferred, the fact that certain restrictions, in many instances quite rigid, are now in force abroad shows plainly that some such measures are sure to be adopted sooner or later in this country, and also that it is important that the profession should keep the matter sufficiently well in hand to forestall any unreasonable action on the part of the law makers, who, when left to their own devices, are almost sure to impose some ill-considered and unjust measure. There appears to be a prejudice with some architects against the license idea, on the ground that it places them in an undignified and unprofessional position. But such objections can be easily disposed of by calling attention to the fact that both doctors and lawyers now practise under similar conditions to those under which it is proposed to place the architect.

AT a meeting of the Executive Committee of the T Square Club, held September 17, a series of resolutions was adopted condemning the action of the State Capitol Commission in violating their agreement with competing architects, and in disregarding the recommendation of their own experts and the warnings of the Governor. The sentiment of the club is clearly shown in the following resolutions:—

"*Resolved*, That the architectural profession, and the citizens of this Commonwealth, are warned that the evident intention of a majority of the Commission to select an architect without reference to the terms of the contract they have made is a public scandal which calls for immediate correction.

"*Resolved*, That this Club pledges itself to the distinguished and honorable Board of Experts to uphold them and the reputable element in the profession in their protest against the disgraceful action of the majority of the Commission."

Brick versus Wood. III.

BY R. CLIPSTON STURGIS.

IN the preceding articles I have touched upon the advisability of using brick from motives of economy and beauty, and its adaptability to all kinds of work and all localities. I wish now to take up, perhaps, the most important part of the subject. How can a better and more frequent use of brick be encouraged?

ENTRANCE COURT, COOMBE WARREN.
George Devey, Architect.

First, I think, by more diffused knowledge. People generally do not appreciate, what I have, perhaps lamely, tried to show, how beautiful and appropriate brick is. They should learn why wood should not be used for any building which lays claim to dignity or importance, even if it be but the dignity of that lowly place a home, because, being perishable, it does not, cannot fulfil the demands made on it by such a building.

Then, wood being set aside, they should learn that the material which, other things being equal, is nearest at hand and cheapest to use is in most cases the best. This material is generally brick; where stone is handier or cheaper, then use it.

Wood is justified only in two ways; either because it is the only material available, or because land must be cleared of timber, and it is the easiest and least wasteful to keep the saw-mill going and build your buildings with the by-product of cultivation. Both these circumstances belong to a phase of life which we have happily outlived, at all events where architecture, as an art, exists.

If wood is used under the force of circumstances, it must ever be looked upon as a temporary expedient. It is not to the advantage of the present owner and indweller to live within wooden wails, and it is certainly not to the advantage of those who will follow him. It is not only that it is using a perishable material for a permanent purpose, thus endangering one's own household and your neighbors', but that one is using as a building material that which has other and, in many ways, more important uses.

For furniture, cabinet work, and innumerable small wares wood is indispensable, no other material can well replace it in these fields, and these are the natural markets for wood when cut. It is equally, I might say even more, useful standing, for it alone preserves us both from drought and from flood.

The great forests at the head waters of our rivers hold the winter snows and release them gradually to keep full the rivers, and to thus irrigate and fertilize the lowlands. Once remove these forests, and the spring sends the snows down in one mighty rush, to flood the country, devastating the land, leaving ruin in its track and drought to follow.

It is to the shame of our intelligence that we are so slow to waken to the necessity of husbanding our wood. We refuse to reserve our still wooded tracks, and we invite, yes, urge, wholesale destruction by putting prohibitive tariff on timbers from other countries. The folly of such a course seems inconceivable. When our hills are denuded it will be too late.

Thus while we are gratifying a perverted taste and building of wood we are endangering our own safety and that of our neighbors, and at the same time encouraging an industry which is fattening on the life blood of the country, in injuring its agricultural productiveness. There is no possible merit in encouraging this industry, for the trade in building lumber is not one which benefits the community at large, but one where the profits, unwholesomely large, go into a very small number of pockets.

As to the quality; this, of course, varies with localities, and in many places they have no reason to be ashamed of their common brick; but there are many kilns which turn out irregular and uneven brick, with great variations in size as between the hard burned and the soft. For this there seems to be but little excuse.

As to uniformity; there is now no standard brick, and if backing and facing are different, you must trust to luck for a bond here and there where the courses run level. This lack of uniformity is still worse from the architectural point of view, for in any given brick building the drawings cannot be made accurate until the builder has been settled upon, and he in turn has decided upon and bought his brick. Then only can you tell how thick a two-brick wall is, or how long a pier of four stretchers, or whether you can manage to make eight headers fill the four-stretcher space — nor can you course off your façade and tell how many courses high are your window openings.

No one but an architect can realize how intensely perplexing and annoying this is.

A uniform brick — at least for all common brick — would obviate this, and the uniform brick, of whatever size, should at least comply with the requirement of two headers and a joint equaling a stretcher.

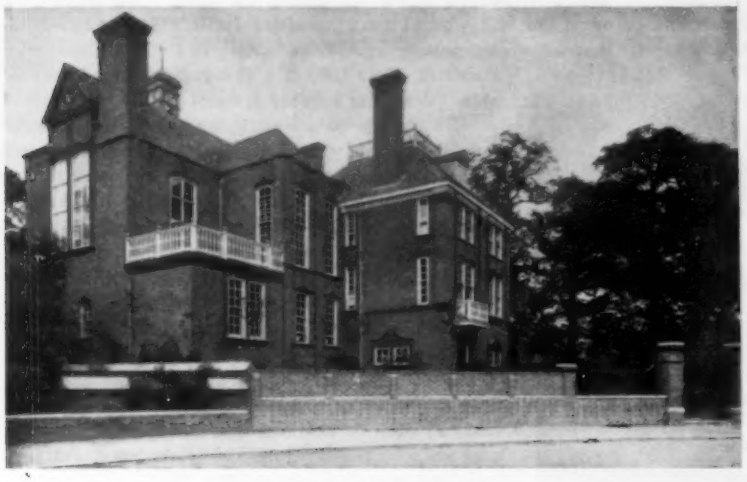
Then, as to the steadiness of the supply. Some of our kilns are summer affairs, and only then can brick be made.

This is particularly discouraging in the very places where I think brick building should be encouraged. In the cities one can always depend on the large brickmaking centers where machinery is used, and the work is carried on regardless of weather; but in the

GARDEN FRONT, COOMBE WARREN.
George Devey, Architect.

country one must depend on local supply unless freight rates are favorable.

This is a most uneconomical way of doing business. To have a large piece of land, with buildings and machinery standing idle and profitless for six months, is not the way to produce cheaply. Apart from the business aspect, it is annoying to an architect or builder to find that when he is ready for brick he can't get them from the kiln he prefers because they are sold out, and no more can be made until the spring opens; or, perhaps he has got the plain brick and wants a few bullnose, or other simple molded brick made from the same clay, and he can't get them, but must use face brick with his common brick, and spoil them both.



LUKE FIELD'S HOUSE, KENSINGTON.
R. N. Shaw, Architect.

But most important of all is it to get the cost brought down where brick can actually compete with wood, that is, the brick that must of necessity be used in the less expensive class of buildings; and this, I believe, is possible, and, in view of the certain rise in lumber, as our unfortunate forests are laid low, probable, too, and that at no very distant date.

A very common grade of brick, if they were of good proportion, would answer perfectly well for the cheaper class of buildings, and would be laid more quickly and to better advantage. The same would answer for backing, and would bond with the various superior bricks. One frequently meets with the absurdity of a higher price from a local kiln than the price, including freight, from a kiln two hundred miles away.

To sum up, I have tried to show how economical and beautiful the brick wall is, and how adapted it is to all situations, and have pointed out what seems to me the best methods of encouraging the use of brick; I can only hope that I may, at least, have opened up a line of thought among builders, architects, and brickmakers that may lead to action on this important subject.

I am aware that I have treated the subject very cursorily, and also keenly aware that I am attempting to give suggestions in a trade which I have never learned; it is only on the principle of judging by their fruits that I have dared to judge at all; but of this one thing I feel certain, that we are using wood too much in our building, and that some day we shall pay dearly for it.

The illustrations in this article have no immediate connection with the text further than exemplifying some good things in brick.

Coombe Warren was built fifteen years or so ago by the late George Devey for Bertram Currie, Esq., and although somewhat heavy in detail, it is virile and interesting — more so than much of the over-ornamented Italian Renaissance which we see so much to-day.

Morley's place is also by Devey; it stands on the site of an old house, "Hall Place," and has the advantage of retaining the old garden. With the rapid growth of vines and shrubs, and England's moist and mellow touch, it looks to-day almost like an old house.

MORLEY'S PLACE.
George Devey, Architect.

CHURCH FOR COLORED PEOPLE, BOSTON.

Luke Field's house, on Melbury Road, Kensington, is by Shaw, one of his most happy examples of the many houses for artists which he has built, so absolutely simple and homelike in appearance, and yet so distinctly fitted for its purpose.

The last illustration is a small church for colored people, built a few years ago in Boston.

Architectural Terra-Cotta.

BY THOMAS CUSACK.

(*Continued.*)

THE two Doric columns described in a preceding chapter were, we presume, introduced chiefly with the view of affording some visible means of support to the sub-cornice resting upon them. The word *visible* is used advisedly, for the invisible has been provided in the manner shown at Fig. 33. This occurs at the fourteenth

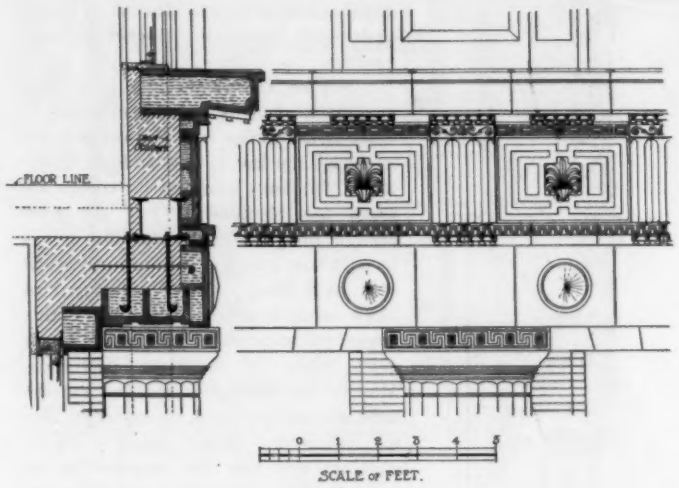


FIG. 33.

story of Fig. 34, which is the Central Syndicate Building, Broadway and Pearl Street, New York. The member referred to spans a recess of some depth, and of two stories in height, which, in its turn, becomes a central feature of the frontage overlooking that famous thoroughfare. Just why the least flexible of the classical orders should have been chosen, in an effort to clothe and embellish an avowedly unsympathetic anatomy of steel, would, we suppose, admit of more than one explanation. On that point, however, we are not inclined, at this moment, to hazard a conjecture. Suffice it to say that the effort *has* been made, and that, too, under circumstances sufficiently exacting to exhaust the resources, if they did not tax the complaisance of most architects.

Our concern at present is chiefly with the cornice, and most of what is said applies to the upper stories of this building. In dealing with these, there may be a doubt as to whether the designer had any very definite object in view; but the doubt is a reasonable one, and of it he shall have full benefit. We shall, therefore, assume that it was his intention to create, at an altitude of 200 ft., an effect proportionate to that obtained in classical examples at about one fifth of that height. If he has fallen short of this ideal, no one will attribute his failure to a lack of ambition. It was certainly a lofty one, however hopeless of attainment. He has not, it will be observed, attempted to do this by a relative enlargement of all the moldings, but by a redistribution and repeated use of the orthodox members, arbitrarily assigned to new situations. Thus we have the architrave, frieze, and cornice of the Doric order combined; and, as a single member of 6 ft. 8 ins., it is made to serve as an enlarged architrave. What would ordinarily have been the frieze is utilized as the fifteenth story; the piers taking the place of triglyphs, and the windows becoming metopes, minus the ornament. On top of these comes the actual cornice, with a projection of 5 ft. 9 ins., making a total of some 20 ft. from soffit of architrave, or about one tenth of the entire height from grade level.

What the ancients of Athens, or their less scrupulous successors of Rome might have done, or left undone, in the face of such a problem has been discussed with avidity among architects. This subject would seem to possess a peculiar fascination, and being still an unsettled one, it has been rediscussed by the wise men among them, with special reference to this building. Nine months or so have elapsed since its completion, and up until date of writing they have not, so far as is known, agreed upon a verdict. The prevalent impression is that upon so remote a contingency it would be idle to speculate, at which status, the question may be allowed a long rest.

The Greek architects belonged to a classical era in the world's history, while it is our lot to live in an age of iron. They had their own problems, which they solved to their own satisfaction, and to the admiration of succeeding ages. Their talents found sufficient vent in the pursuit of subtle refinements, and when these reached the acme of human perfection "a deep sleep" fell upon them. Should they awake in this commercial age, the perplexities of the situation might worry them more than they appear to have done the up-to-date designer of this modern office building. He, we doubt not, consoles himself with the reflection that they have been a long while dead, and so are not likely to turn in their sarcophagi over this latest, though not least daring transposition of their exquisite detail.

In consideration of what has been said, we give a number of details, as drawn from the models, all of them giving an accurate representation of the work as executed. Most of these may be left to speak for themselves. In the main cornice (Fig. 38) certain peculiarities in the design made it necessary to devise a somewhat different method of construction from that shown in previous examples. This change is made imperative by the absence of modillions, which, among other things, served to conceal the inverted ⊥s, heretofore used as cantilevers. The whole of the soffit being now exposed, the iron supports must be inserted some distance from the surface. Instead of ⊥ sections we now find it expedient to use 5 in. 12 lb. I beams, for which an exact counterpart is molded in the ends of each block. These soffit blocks are made in one piece, with a hole in the center, into which the rosette is keyed at the time of setting. In the setting, too, of this cornice, different methods of procedure must be resorted to. Of these we know of but two that are practicable, and between them there is little room for choice.

If it be decided to space the cantilevers and make permanent riveted connections with the structural ironwork, that may be done before the walls have reached their full height. They must, in that case, be spaced accurately to the dimensions furnished by, or previously agreed to with the terra-cotta maker, who, meanwhile, has his work too far advanced to admit of material alteration. It may be that he has it made, perhaps fitted to these figures, and ready for shipping on demand. They should likewise extend at right angles to the building line, resting on an unyielding fulcrum, and be adjusted to perfect alignment. We have reason to know that these fundamental conditions do not always receive the attention that their importance demands. The drawings supplied for this purpose may be complete, and as perfect as it is possible to make them; it does not by any means follow that the erection of the work

FIG. 34.

will be equally so. The iron-workers, at least, have a stable material on which correct measurements may be made, and the holes punched, or, when necessary, drilled with mathematical exactness. This, of course, calls for reasonable care and consideration on their part; two qualities which they should be encouraged to cultivate. We are very far from saying that they are the only class of workmen to be met with on buildings who are wont to excuse themselves by the use of a well-worn "near enough" or "good enough." It is, nevertheless, a fact that they use these exploded maxims, and, what is worse, appear to act upon them far too frequently. A more rigid supervision is certainly required in such matters, and where other influences fail, the contracting engineer should be held to strict account by the architect. A few elementary lessons would not be amiss, as an aid to memory, the more salutary if of a pecuniary character, and taught him at his own expense.

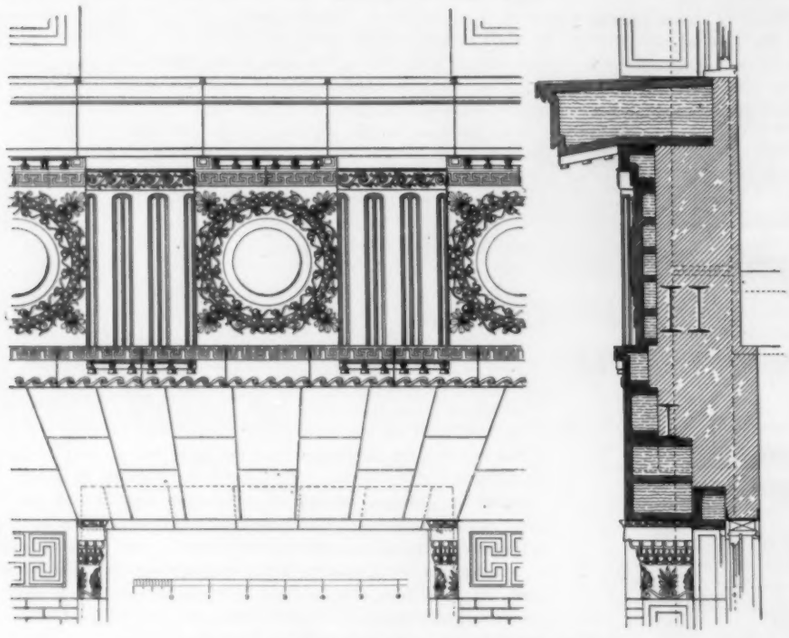


FIG. 35. CORNICE BETWEEN 4TH AND 5TH STORIES.

Assuming, for the moment, that the ironworkers have done their part intelligently, the same thing will be expected from the men entrusted with the setting of the terra-cotta. Their first requisite is a scaffold of extra width, and, it may be added, of extra strength, in order that the blocks may swing clear of the cantilevers and then slide in between them. When this plan is adopted the chief drawback encountered is in getting sufficient mortar into the vertical joints. We fear there are cases where this difficulty was deemed a sufficient excuse for setting them dry. The terra-cotta manufacturer, however, can do much to invalidate this pretext by providing vertical grooves in the ends of the blocks. Into these, cement grout should be run; it will find its way down as far as the iron, for which it will be a preservative, at the same time filling most of the interstices.

The other, and perhaps better, plan is to have all the cantilevers fitted and marked for their respective places, but not fastened. As each block of terra-cotta is bedded in position it is followed simultaneously by a cantilever, which may be held in place temporarily by a bolt, to be replaced by the usual rivets as soon as convenient. This allows mortar of sufficient stiffness to be spread on each end of the block, which, when pushed together on the iron, leaves no unfilled crevices in the joint. But, whichever plan happens to be adopted, no extraordinary effort is presupposed, much less demanded, from anybody concerned. In addition to the skill which most workmen claim as their stock in trade, a reasonable amount of cooperation and helpfulness is all that is needed. This, if not expressly stipulated in every specification, is tacitly understood, and is the essence of every contract.

Beyond the points that have been suggested, there is but one criticism to make in connection with this cornice, and it, though the last, is not the least important. The lions' heads on the corona are much too plentiful. They are good enough things in themselves, but it will be seen how easy it is to have too much of a good thing. A head on every third block would have been ample, and in this respect our example of last month comes much nearer to the right disposition. Most of the moldings introduced into the soffit are too small, and, consequently, also too numerous. These small undercut members were put in at considerable expense to the manufacturer, and the most regrettable part of it is that when viewed from the street they represent nothing, unless it may be so much wasted effort. Ruskin was thinking prospectively as well as retrospectively when he wrote of things such as this being "fused together in nebulous aggregation." Fewer and bolder members, with sufficient cinctures to give relief, would, we think, have been a decided improvement, and these could have been had for the asking. The foregoing are faults for which no excuse can be offered, but if it be any satisfaction to those responsible for them, we will say that they are in what may be considered good company, architecturally. Such failings, if not common, are certainly not confined to this building. We know of cases in which the size of the members began to diminish in inverse ratio to their height in the building. The smallest leaf used by one eminent member of the profession was withheld from the entrance vestibule and reserved as an enrichment for coping on the parapet.

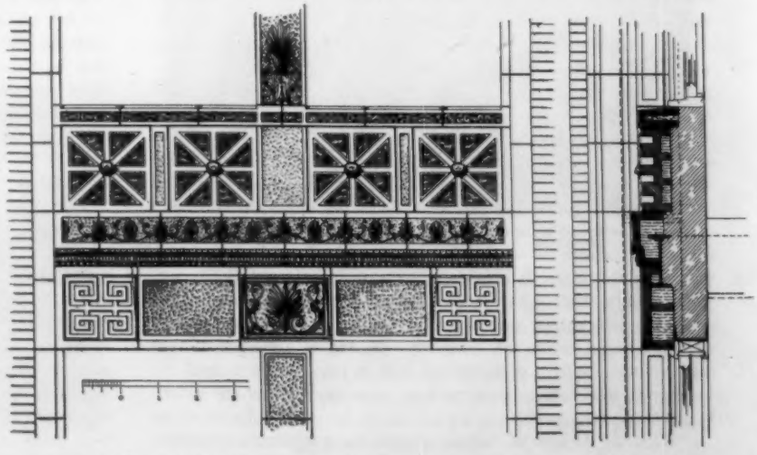


FIG. 36. TRANSOM IN WINDOWS BETWEEN 4TH AND 5TH STORIES.

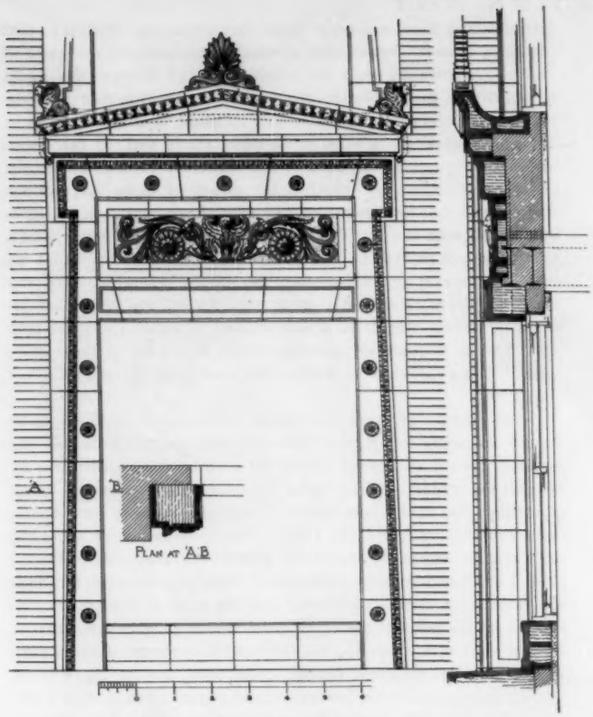


FIG. 37. WINDOWS IN 12FTH STORY.

It is difficult to account for this well-nigh unaccountable tendency. One explanation may be found in the fact that the average draughtsman views his work at too short a range, viz., the drawing board. Let the physical eye follow the lines that are being made on paper, by all means, but let the mental vision soar to higher altitudes, and there picture the complete work *before the foundations have been dug*, proportioning each detail to what it should appear when placed at any given height in the building.

BRICK EFFLORESCENCE.

A GERMAN'S OPINION.

THE incrustation or efflorescence of bricks and brickwork through weathering formed the subject of an inaugural address by Professor Gunther at the University of Rostock, North Germany. Mineral incrustations on walls are mostly white or grayish, more rarely yellow or green — these latter being due to vanadium, a silvery brittle metal of rare occurrence. In appearance these incrustations vary, according to the solubility of the component salts, from floury or wooly powders to stalactitic masses; and they may result from various causes present either in the raw clay or introduced in the water employed in brickmaking, or from pyrites in the clay or fuel, or from the ash of the latter material; and the infiltration of soluble substances from the mortar, or combination of the alkalis in the latter with the gypsum in the bricks; or, finally, the absorption of nitrates from the soil and from the air of ammonia or sodium chlorate (near the sea) may give rise to incrustation. Incrustation may come either from the bricks or from the mortar. While incrustations of calcium carbonate do no harm beyond spoiling the appearance of the work, soluble alkali salts repeatedly dissolve and recrystallize in the cracks — ultimately producing disintegration. To prevent these incrustations, pyrites, and sulphates can either be removed by the slow process of seasoning the clay by prolonged exposure to the weather before making up into bricks, or by adding barium salts to the clay before burning, so as to produce the insoluble barium sulphate. Bricks should be very thoroughly burnt, since in this state they are less disposed to absorb the moisture necessary for the extraction of the soluble salts. — *The British Brickbuilder.*

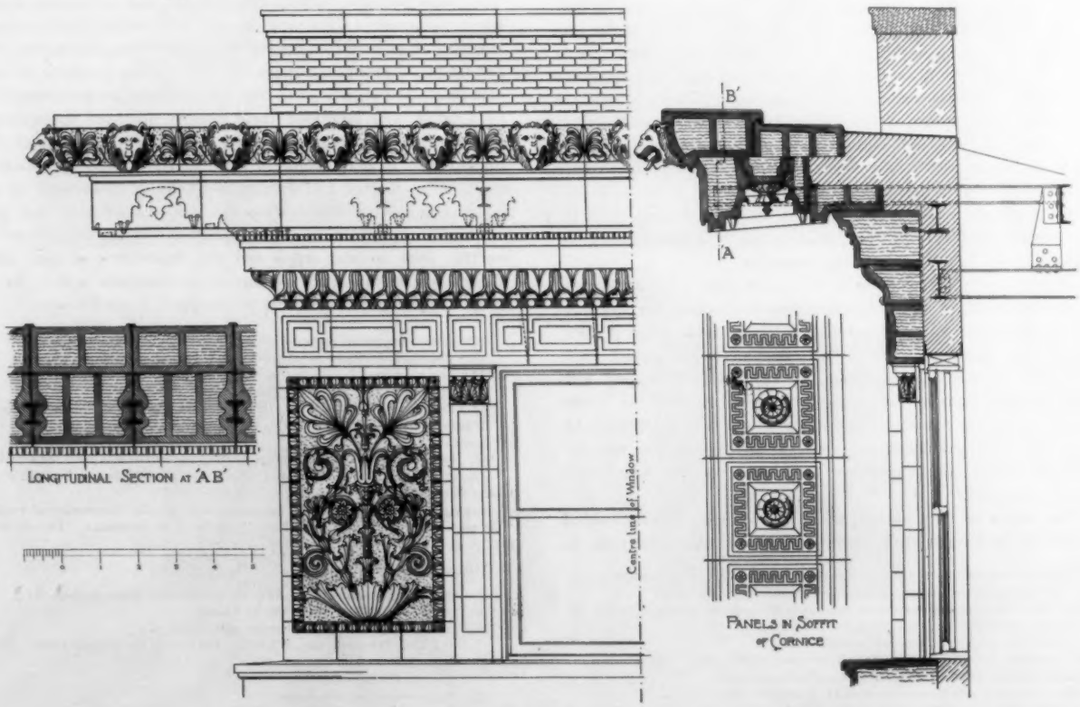


FIG. 38.

The Art of Building among the Romans.

Translated from the French of AUGUSTE CHOISY by Arthur J. Dillon.

PART III.

CHAPTER II.

THE ART OF BUILDING AND THE ORGANIZATION OF THE WORKING CLASSES.

I HAVE reviewed the principal epochs of the history of Roman construction, and the circumstances that attach it to the history of the empire. I now wish to go a step farther, and, without stopping over the exterior causes that in turn hastened or retarded the progress of the art of building, go back to the influences which the interior organization of society has in its methods. What part had free labor? What part had slavery? In what ways, from what parts of the people, were procured the thousands of workmen who built the monuments of Rome? In what way could their efforts be utilized, and what were the practical methods that were consequently preferable? All these questions are related to each other. The condition of the working classes is shown in the construction of the edifices as plainly as the Roman customs are shown in their plans; and the principal interest in the study of construction would be lacking if the account of the methods were separated from the account of the institutions that explain and justify them.[1]

One institution, among others, whose name constantly recurs in the Roman laws and inscriptions is that of the corporations or colleges of workmen; strange associations, the details of whose regulations, unfortunately, the ancients failed to transmit to us, and whose history must be sought by the difficult comparison of scattered documents. Sometimes a concession of privileges, sometimes a law on public taxes, gives us a trace of their immunities or their obligations; one inscription gives us a glimpse, in lists of titles as obscure as they are numerous, of a complex hierarchy established in each of the corporations; another inscription reveals, in fragmentary sentences, a series of statutes freely accepted by the corporations, regulating the relations of the different members. These are truly very incomplete documents, but in spite of the unfortunate vagueness of many of them, the general impression obtained from a review of the whole mass is of a certain clearness; and one fact of capital importance seems to be shown by this incomplete evidence; it is the existence of a working class, widely separated from the rest of Roman society, and placed, by an hierarchial organization and by a system of privileges and duties, in the hands of the emperors.

Moreover, this organization is of recent date. Before becoming an instrument of the centralized imperial power, the workingmen's corporations had a long struggle to obtain recognition of their existence and sanction of their franchises; a struggle which commenced with the first days of Rome, and which was prolonged with varying fortunes for a period of nearly eight centuries; for it was only under Hadrian that the corporations finally took a definite rank among the recognized institutions, and commenced to play that important part in the internal economy of the empire that was henceforward to be theirs.

The origin of the workingmen's corporations is confounded with that of the Roman state; perhaps their creation must even be placed among those numerous things borrowed from Etruria in that period of peaceful organization to which historians give the name of Numa. Afterwards, when the attention of the Romans was again turned to war, the institution, temporarily overthrown, rose in a new form; the corporations that were able to assist in military works, in the equipment of the armies, in the manufacture and the maneuvering of the engines of war, became the important ones, and when the people were classed by centuries, the power of these corporations was so great that by themselves they formed two centuries, voting in the *comitia* with the first class of Roman citizens. This privilege, to be sure, was enjoyed by a large number of corporations which we could not investigate without going beyond the natural limits of this study, but there are several of them in which we are particularly interested; among others, those who worked in metal and wood took rank in these half-military societies, which, according to the expression of Titus Livius, were soldiers by trade, though they did not bear arms.[2]

The example of these first corporations, the ever-increasing influence that they had in the Roman society greatly increased the tendency toward association among the working classes, and little by little all the trades of Rome were organized as corporations under regulations that made them similar in varying degrees to the corporations instituted by Numa and Tulla. Objectionable above all to the last Tarquins, and to the aristocratic government that followed the expulsion of those kings, the existence of these popular confederations was more than once in question;[3] but the spirit of association prevailed over the prohibitions of the patricians to such an extent that at the last years of the republic the whole of the workmen of Rome were formed into free societies, strongly constituted, and having, with or without the consent of the government, an organization that, to a certain degree, put them beyond the control of the central authority.

It would appear that the material advantages were rather the pretext than the real basis of these unions, and about the time of the civil commotions that preceded Augustus, the interests of the factions into which the Roman world was divided gave the workingmen's corporations one of the principal elements of their power. They were animated by a seditious spirit, and numerous revolts (in which the name of Clodius, it is said, was mixed) finally moved the Roman government to a distrust of the principles themselves of these institutions. Prohibited under the rule of Cicero, in spite of the support they had formerly given him, the corporations were reestablished by Clodius, who increased their number, admitted foreigners, and even slaves, and increased in them the unquiet spirit which forced Julius Cæsar to again suppress them.[4] Only a few exceptions were made, through respect of ancient traditions, or on account of regard for general needs. The fate of the corporations who took part in construction, whether they were comprised in the condemnation, or whether their ancient origin and the importance of their services placed them in the small number of corporations which, the documents say, were spared for the public good, is not known.

[1] Besides the original texts to which I refer, the following works can be consulted in relation to the questions which are the subject of this chapter: —

Heineccius, De collegiis et corporibus opificum (a dissertation reproduced in the collection called Opusculorum variorum sylloge).

Serrigny, Droit public et administratif romain.

Th. Mommsen, De collegiis et sodaliciis Romanorum (Kiliæ, 1843).

Rabanis, Recherches sur les Dendrophores (Bordeaux, 1841).

Roth, De re municipali Romanorum libri II. (Stuttgart, 1801).

But kindly advice has assisted me more than these learned works, and I beg to acknowledge my gratitude to M. Egger for direction he gave to my researches.

[2] The original documents on the origin of these corporations are these: —

1st. Establishment of the corporations under Numa as peaceful organizations.

Plut., Numa, Cap. XV.

Plin., Hist. Nat., Lib. XXXIV., Cap. I.

2d. Transformation of many corporations into semi-military institutions, under Tulla.

Dinoys. Halic., Ant. rom., Lib. IV., Cap. XVII.

Tit. Liv., Lib. I., Cap. XLIII

3d. Persistence of distinctions in favor of the corporations who aided the armies.

Digest., Lib. I., tit. VI., l. 6 (taken from a treatise, "Militarum," written about the time of Commodius).

Among the concordant works on these documents, see the dissertation of Heineccius, "De orig. et jure coll. et corp. apud Rom.," and that of M. Mommsen, "De coll. et sodaliciis," p. 27, et seq.)

[3] Heineccius, "De orig. et jure coll.," Cap. I., § 9.

[4] Some of the documents on which these statements are founded are these: —

1st. Suppression of the corporations by Cicero.

Asconius, in Corneliana Ciceronis, edit. Orelli, p. 75.

(Cf. Cic., Pro domo, Cap. XXVIII.; and Q. Cic. De petitione consul., Cap. I.)

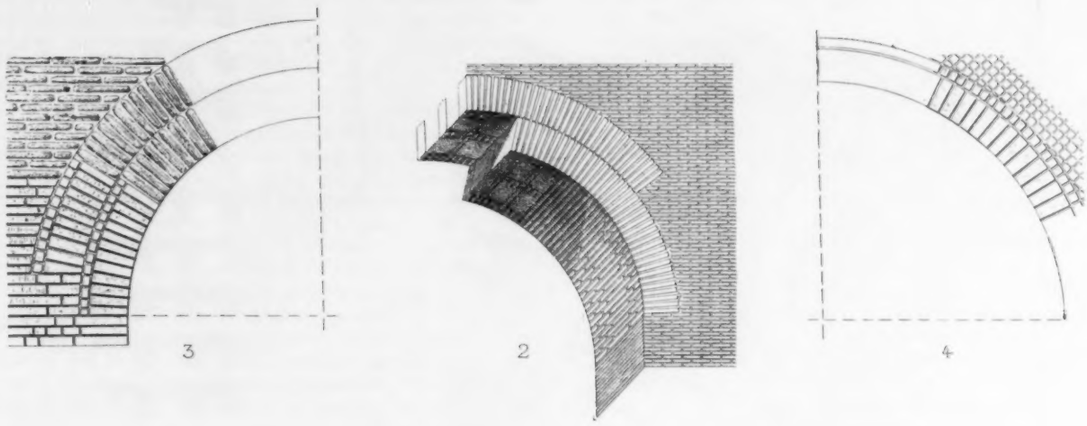
2d. Reestablishment by Clodius: —

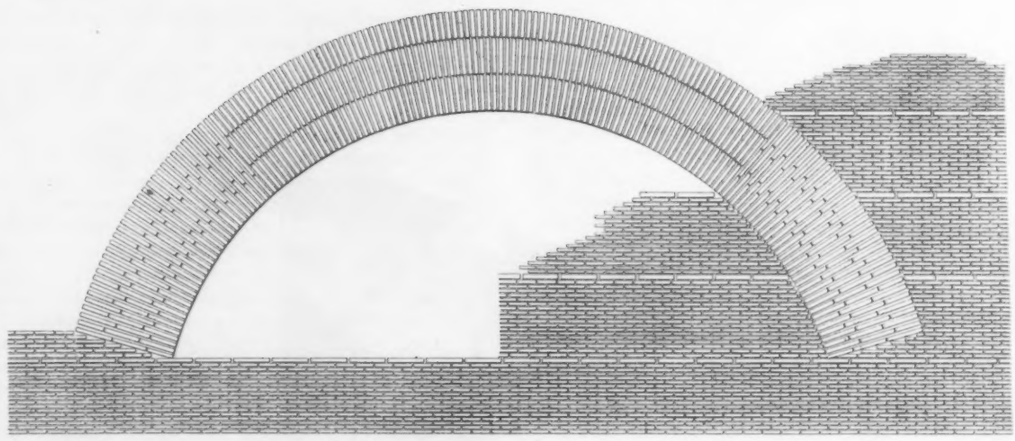
Cic., in Pisonem, Cap. IV.

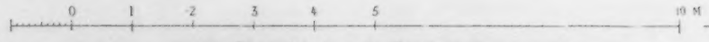
3d. Suppression by Julius Cæsar;

Suet., Jul., Cap. XLII.

(For the discussion of these documents see the memoir of M. Mommsen.)

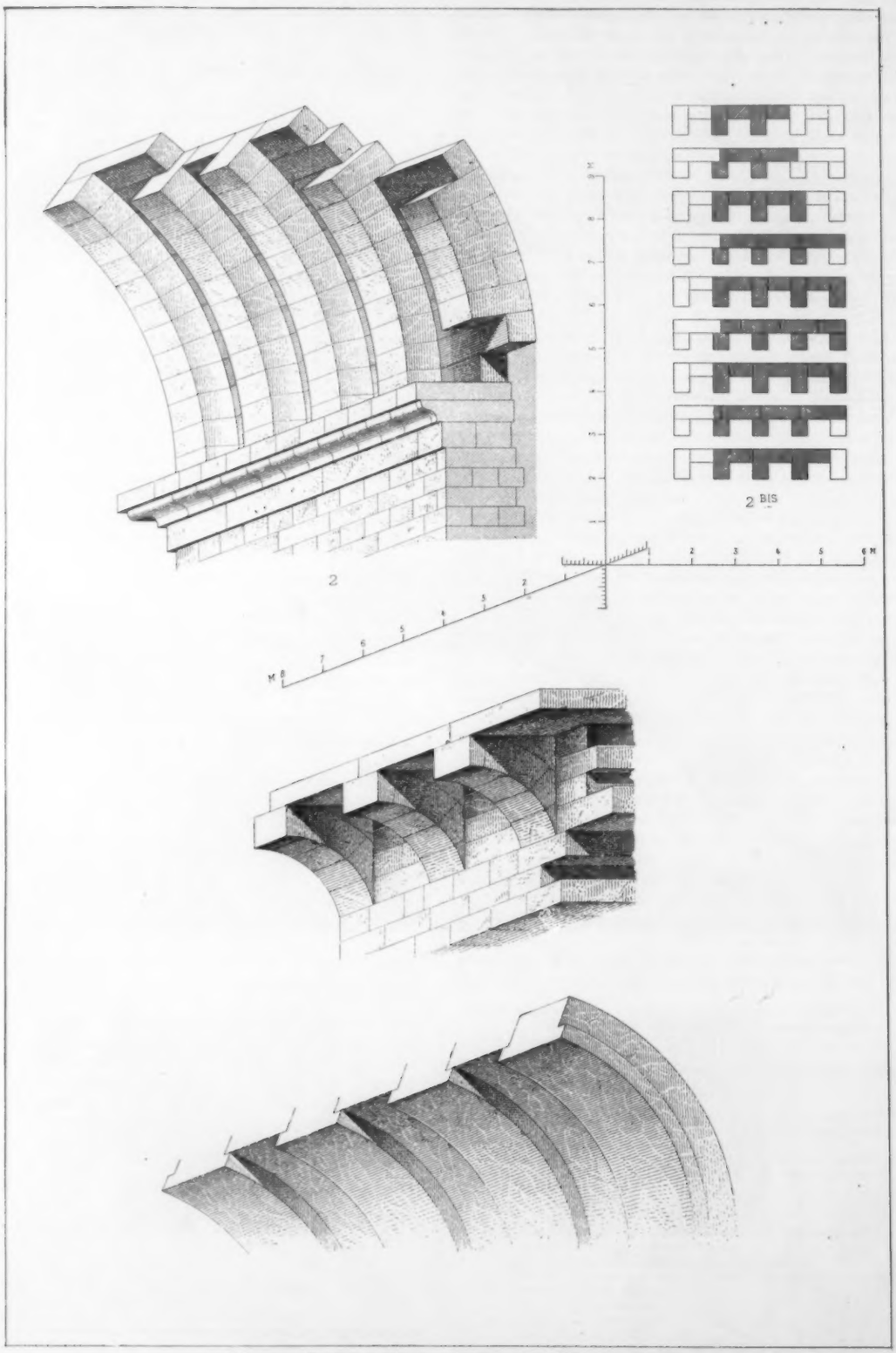






1. Pantheon. 5–6. Taormine.

PLATE XV. THE ART OF BUILDING AMONG THE ROMANS.



1. Bains de Diane a Nimes. 2 and 2 Bis. Point de Narni.

PLATE XVI. THE ART OF BUILDING AMONG THE ROMANS.

However that may be, the frequency of the edicts published against the corporations during the period of a century shows what permanence the idea of association had. From Julius Cæsar to the Emperor Claudius, three successive edicts confirm in turn the first interdictions.[1] Finally renouncing the direct contest against a tendency that increased in proportion to the efforts opposed to it, the emperors, little by little, placed themselves at the head of the corporations, and in order to dominate them, they profited, it seems, by the religious character which was found, as well as the idea of association, and the partisan spirit was found in them.

Nero had himself made a priest of all the corporations tolerated in Rome,[2] and a great number of the corporations that had been overthrown were reconstituted under the open patronage and the somewhat perfidious protection of the pontifical power of the Cæsars. But the direction given to the workingmen's corporations by the supreme authority was not sufficient to stifle the fear of them for any long period. Trajan tried, but in vain, to revive the ancient interdictions; and during the first years of the second century there is the singular spectacle of a Roman emperor compelled to recognize in Rome the unions he is endeavoring to suppress in the provinces.[3]

Hadrian was the first to understand the fruitlessness of the effort to stop the movement. He abandoned both the idea of suppressing the corporations and that of transforming them into simply religious societies; they seemed to him to afford valuable resources for the execution of the great edifices he was planning; he saw in them a powerful instrument which he strove to put to profit in the interest of his vast enterprises. Henceforward the workingmen's corporations lost their primitive character of free associations and became official institutions of the State, a fundamental change which marked, for the greater part of the working classes, the point of departure of an entirely new régime, of a condition of affairs whose developments fill the long period that elapsed from Hadrian to Theodorus.[4]

The new condition imposed on the corporations of builders is indicated in a few historical texts, but it is most plainly marked in the regulation of Antoninus and his successors, while the definite form it took in the last period of the empire is shown in numerous texts preserved in the Theodosian Legislation. Aurelius Victor says (epit., cap. XIV.) that Hadrian has enrolled the building trades in cohorts, organized after the model of those of the armies. "Ad specimen legionum militarium, fabros, perpendiculatoris, architectos, genusque cunctum exstruendorum mucnium seu decorandum, in cohortis centuriaverat."[5]

This testimony is made clearer, though the well-defined, original form leaves no room for doubt, by regulations which may be attributed to the immediate successor of Hadrian. The jurisconsult Callistratus expresses himself thus, in summing up the measures taken by Antonine Pius in regard to the corporations: —

"To certain corporations . . . immunity is granted; these corporations are those to which admission is obtained by virtue of a trade, such as the corporation of smiths, and all those which have a similar origin, that is to say, which were established to give the aid necessary to enterprises of public utility. . . ." "Quibusdam collegiis vel corporibus quibus jus cœundi permissum est, immunitas tribuitur: Scilicet eis collegis vel corporibus in quibus artifici sui causaunus — quisque adsumitur: ut faborum corpus est, et si qua eamdem rationem originis habent, id est idcirco instituta sunt, ut necessariam operam publicis utilitatibus exhiberent," etc. (Digest., Lib., tit. VI., l. 5, 12).[6]

I thought I should give this curious document in its entirety, for it defines both the kind of servitude imposed on the corporations and the reasons for giving the privileges that were granted to them in return. The privileges enjoyed by the corporations were above all a recompense for the duties that weighed on them. The emperors had to recompense by indemnities the extremely onerous obligations that bound the members of a corporation to give their services in this manner whenever a public necessity demanded their assistance.

This was the fundamental idea on which the workingmen's corporations rested, but it will be of interest to go beyond this generality, and endeavor to fix the nature of the requisitions which their members were compelled to meet, the character of their immunities, and the principal points of their internal organization.

The servitude imposed on the corporations did not consist of the obligation of giving their work to the State gratuitously, but only of the obligation of giving it; it was an infringement of personal liberty, nothing more, but none the less a serious infringement when judged either by the importance of the compensation given for it, or by the severity of the penalties decreed against the members of corporations who should endeavor to escape the charges put on them by flight.[7]

It was no less a matter than that of placing one's self absolutely at the discretion of the State, of continually residing at the place where the corporation did its work, and of accepting as the price for these services whatever the State was pleased to grant. It was, as can be seen, essentially a dependent condition that has more than one point in common with that of the Roman colonists, or, better still, with that of those singular dignitaries of the last days of the empire, who, under the name of curials, were given honorary duties under ruinous conditions by the despotic emperors. Looked at from no matter what point of view, Roman society seems to have been based entirely on a system of servitude partially repaid by privileges.

But the members of the corporations were more fortunate in this respect than the classes to which we have just compared them, for the immunities granted to them in return for their heavy obligations were a less illusory compensation. Their privileges consisted in their absolute exemption from all public taxes, from all municipal duties, and from all extraordinary imposts; they were not subject to the corvée, nor to military service, and were entirely free from the burdensome impositions which, under an infinite variety of names, crushed the other classes of Roman society.[8]

Apart from these advantages, the workingmen's corporations received from the State a gift of lands whose revenue was included in the remuneration for their services. The lands comprised in these

[1] 1st. Under Julius Cæsar; Suet., Jul., Cap. XLII.
2d. Under Augustus; Suet., Aug., Cap. XXXII.
3d. Under Claudius; Dio. Cass., Lib. LX., Cap. VI.
(This last document seems also to indicate the commencement of tolerance on the part of the predecessor of Claudius.)

[2] Orelli, Inscript. lat., No. 764 (note); I have taken this from the paper of M. Belin de Launay in the Acts of the Acad. de Bordeaux, 1867, 1er tri.

[3] Prohibitions: Plin., epist., Lib. X., 42 and 43. Recognized corporations: Aurel. Vict., De Cæsarib, Cap. XIII.

[4] It may be said in passing, that this change in the character of the corporations, which commenced by being tolerated and ended in being obligatory, explains a certain lack of agreement between the juridical documents in the Digest. Taking the oldest of these texts, those of Gaius, for example, the workingmen's corporations are almost invariably presented as tolerated associations (see in particular Dig., Lib. III., tit. IV., l. 1). On the contrary, taking the constitutions of the fourth and fifth centuries, they all imply a different character to the corporations, that of obligatory associations. The means of compulsion which are cited farther on belong to this period, and sufficiently mark the nature and importance of the transformation that was made.

[5] "He had enrolled as cohorts, according to the model of the military legions, the smiths, terracers, the architects, and all that group of artisans who build or decorate.

[6] This enunciation, taken from a jurisconsult of the second century, is enlarged upon, and made still clearer by Majorien, who shows us all the members of the corporations compelled to live in their own cities in order to work for the public benefit in turn (*alternis vicibus*) and at the request of the curiales (*pro curialium dispositione*): Nov. Theod., Lib. IV., tit. I. This is the text of the constitution: "De collegiatis vero illa servanda sunt, quæ præcedentium legum præcipit auctoritas. Quibus illud provisio nostræ serenitatis adjungit, ut collegiatas operas patriæ alternis vicibus pro curialium dispositione præbentibus, extra territorium civitatis suæ habitare non liceat."

[7] Novell. Maj., previously cited, is a sufficient proof of this (Nov. Maj., tit. I); furthermore, it may be confirmed by these works: —
Novell. Theod., Lib. I., tit. XXVI.
Cod. Theod., Lib. XIV., tit. II., l. 4. Lib. XIV., tit. VII., l. 1. Lib. VI., tit. XXX., l. 16.

[8] 1st. Exemption from military service. Novell. Theod., Lib. I., tit. XXVI.
2d. Exemption from municipal duties. This is at least probably established by Cod. Theod., Lib. XII., tit. I., where the two kinds of duties seem to be considered equivalent.
3d. Exemption from taxes or extraordinary imposts. Cod. Theod., Lib. XIV., tit. II., l. 2.
4th. Exemption of minors. Digest., Lib. XXVII., tit. I., l. 17, § 2.

donations, the *fundi dotales*, divided between the members of the corporations, became their individual property, transferable, like other possessions, by inheritance, and it was on account of the importance of the donation that the charges upon them were divided among the different members of the corporation. Each contributed to the service of the State in proportion to the part he held of these lands so heavily encumbered, and the obligations were transferred with the property itself.[1]

Several important consequences were brought about by this, for when the endowment passed from a member of a college to his children, the obligation of fulfilling the public duties would also be hereditary, and by this reasoning, which, in spite of its unfortunate results, was correct, it followed that the Romans found themselves compelled to attach the workingman to his corporation, and to perpetuate a servitude which took from the son of a Roman workingman the right to choose his mode of life, and to select his occupation according to his taste or his needs.

The natural solution would have been to give a choice between assuming the duties of the corporation or abandoning the endowment; and this did not escape the attention of the logical and penetrating minds of the Roman law makers. The terms of the law in this respect are precise, and contain, one might say, the entire theory of the servitude imposed on the workingmen's corporations. "Those who hold under any title whatever, property subject to the charges of corporations, whether they have obtained possession by purchase, gift, or in any other manner, must either take the charges on themselves in proportion to the value of the property or else must give up possession" (Cod. Theod., Lib. XIV., tit. IV., l. 8), and the law adds, this also covers "all the corporations that share in the privileges of the city of Rome."[2]

But it is to be feared that this law, which seems a safeguard of individual liberty, was only one of those speculative matters from which Roman legislation is not free; there is no doubt that in more than one case the strict deductions were put aside at the exigency of certain less favored corporations that had become, through long custom, necessary organs of the imperial administration. The emperors arrogated the right of placing citizens in the corporations on their own authority, and of transferring members of one corporation to another; and, above all, as though they feared a lack of members, forced membership in those corporations whose duties were the most burdensome was made a legal penalty.[3]

Thus, by means of a wisely tyrannical discipline the Roman government provided for the general necessities of public works and for the provisioning of the large cities. The workman or merchant of the Roman empire was not an independent citizen who worked according to his own will to supply his own daily needs; he was a functionary of the centralized government, receiving, in the form of revenue from an endowment, a regular salary, and bound to deliver, in exchange for this revenue, this salary, the result of his labor either to the State or to the municipality. The State, through its endowed employees, produced directly the provisions necessary for the support of the people (*pistores*, *suari*, etc.), undertook all transportation (*navicularii*, *vecturarii*, etc.), and built its monuments (*structoris*, *tiguarii*, *fabri*, etc.); a strange system which wiped out private enterprise and competition, and which substituted for the spontaneous workings of industry, the machinery of an immense administrative hierarchy which commenced at the emperors and ended at the lowest workman of the large cities.

It can be seen that it would be a serious error to regard the services of the corporations as gratuitous; their endowments and their privileges were a first recompense, but they had also in many cases a further one which was regulated entirely by the importance of the services rendered. I found the proof of this in the curious constitutions that regulated the corporation that was bound to supply Rome with the lime necessary for its buildings, the "*calcis coctores*." Their pay, following a widespread custom of the empire, was not in money but in kind, an amphora of wine for three wagons of lime; the carters who transported the lime (also functionaries of the Roman administration) received an amphora of wine for every 2,900 lbs. of lime, not including the income from their endowed lands, and the produce of three hundred oxen given to their corporation (Cod. Theod., Lib. XIV., tit. VI., l. 1).

It seems, then, that the Roman society recognized the state of subjection which it imposed on the corporations by immunities or permanent gifts, and recompensed each service rendered by a special salary. These benefits, however, reasonable and seemingly equitable, were far from being sufficient to repay the services at their true value; they were, as the Code says, but consolations (*solatium*)[4] which served to lighten the heavy obligations. The State reserved the right of fixing the payments of the forced contractors of its works, and the amounts it paid were but a small recompense, and dissimulated but poorly the semi-slavery. The greater part of the expenses of the city were in reality borne by the corporations; and, to use the language that was used by an illustrious Roman citizen in a petition to the Emperor, "The ancient privileges were bought at a great price; their so-called immunities are paid for by perpetual slavery."[5]

(*Continued.*)

[1] Cod. Theod., Lib. XIV., tit. III., l. 7, 13, 19; tit. IV., l. 8.

The working of this system of donations and duties can be observed by reading the applications the Romans made of it to two of their principal corporations, the *naviculare* and the *pistores*; each of these applications, each of these monographs, as they may be called, is the subject of a special title in the Theodosian Code.

Taking the expressions of the Code exactly, two meanings may be given to the words *fundi dotales*. The donation to the corporations could be a complete abandonment of certain property to their members, or it could be simply the exemption from charges of land held by them. These two hypotheses, neither of which, moreover, excludes the other, carry the same consequences as far as the legal position of the collegiati and the character of their remuneration is concerned: whether the members of the corporations had the revenue of the donated lands as an indemnity, or whether the *fundi dotales* was simply the partial or complete exemption from all imposts entailed by the possession of such lands, the principal remains the same and the conclusions we are brought to remain true.

[2] "Hi vero qui prædia obnoxia corpori, vel ex empto, vel ex donato, vel ex quo libet titulo tenent, pro rata publicum munus agnoscant, aut possessionibus cedunt. Circa reliqua etiam corpora, quæ ad privilegia Urbis Romæ pertinere noscuntur, eadem præcepti nostri forma servetur."

[3] For the participation of citizens in the corporations, and the right of transferring the members of one corporation to another, see Symmach., Lib. X., ep. 58.

For the grade of the condemnation that placed free citizens in certain corporations whose duties were onerous, see Cod. Theod., Lib. IX., tit. XL., l. 5; Lib. XIV, 10, tit. III, l. 23, etc.

[4] Cod. Theod., Lib. XIV, tit. III, l. 19.

[5] Symmach., Lib. X., ep. 27: The "report" from which I took this citation forms one of the most interesting and most complete pictures the ancients have left us of the position and condition of the corporations of the workingmen of the Roman empire.

FREEZING TEST FOR BRICKS.

ONE of the most important features in structural materials of all kinds is their permanence under the influence of atmospheric influences. Of all these perhaps the one that exercises the greatest mechanical effect is frost, which tends to disintegrate bricks and stone by the expansion in the act of freezing of the water enclosed in the pores, with a consequent separation of particles or flakes when thawing ensues. Probably very few of your readers have ever thought of testing the permanency of their goods under such conditions; the winter time provides a seasonable opportunity, and there is no reason why every manufacturer should not, if we have frost enough, be able to ascertain to what extent his goods will stand frost. This can be determined by a very simple test, namely, by direct freezing. Let typical samples of the goods be chosen during frosty weather, and saturated with water, and then alternately frozen and thawed a dozen times or more. Now, if the samples to be tested are weighed dry, and the loss of weight by exfoliation determined also on the dry samples, the thing is accomplished. It would be possible to create a standard of permanency by counting a given percentage of loss as unity (this would have to be chosen arbitrarily) and then referring other percentages of loss to it. Thus might be created a scale of permanency, and when about to enter into a contract, this might be referred to just in the same way as the resistance to crushing strain is now quoted. — *British Brickbuilder.*

Fire-proofing Department.

DETAILS OF FIRE-PROOF CONSTRUCTION WITH BURNED CLAY.

BY PETER B. WIGHT.

PARTITIONS AND WALL FURRING.

HOLLOW-TILE building blocks were invented and patented in this country by the late George H. Johnson, about the year 1872, the purpose of the invention being to construct round or square grain bins in elevators; though numerous forms of rectangular hollow blocks had been made in France before that time. The feature of Mr. Johnson's invention was to cramp the blocks together with burned clay cramps, the blocks being set on end. Thus when the courses were set with broken joints the cramps were concealed. An added strength was thus given to grain bins which are subject to great lateral thrusts. But the invention was of doubtful utility and added to the expense of partition work when used in buildings. It was used for a considerable time by the company which continued Mr. Johnson's work in Chicago, but has since been abandoned. One of these partitions is shown in Fig. 1.

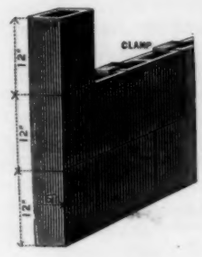


FIG. 1.

The first hollow block used for partitions in New York and the Eastern States in the early 70's was 4 by 6 by 12 ins. in size, with two longitudinal holes. The thickness of the clay was ⅝ in. for hard tile and ⅞ in. for porous tile. One of the latter is shown in Fig. 2. These were used for both 4 in. and 6 in. partitions, and are still the standard article of manufacture by some makers. But they make the partitions unnecessarily heavy, and are more expensive to set than larger and lighter blocks. The tiles for partitions made by Johnsdn were 10 by 10 ins. without any cross webs, and ¾ in. thick. In 1881 partition tiles were used at Chicago which were 12 by 12 ins., with one and two cross webs. They were only ½ in. thick and made of hard fire-clay. An illustration of these is given (Fig. 3). They were generally laid on the side, though, being square, they could be set on end, like the Johnson tile, which was frequently done, especially where the partition was very high or subjected to great weight, as in the surrounding of an elevator shaft. At angles they were always set on end. Greater care and a little more expense is required in setting partition tiles on the ends. This method is also the best when the partition is not to be plastered, as when they are set on the side it is impossible to fill all the vertical joints. This remark does not apply, however, to the 4 by 6 blocks, which are laid like large bricks, and have more surface at the ends to hold the mortar joint. They, however, show the holes at the angles of partitions which have to be filled with mortar. Hollow partition tiles may now be had for partitions 2, 3, 4, 5, 6, and 8 ins. thick, and 12 in. partitions may be had by setting 6 by 12 in. tiles on the flat side. This is a handy way to build light fire-proof vaults in buildings where there are sufficient foundations.

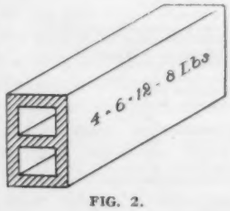


FIG. 2.

The thickness of partitions in practise is regulated by the heights of stories. A 3 in. partition can be safely built to 12 ft., a 4 in. to 16 ft., and a 6 in. to 20 ft. in height. I advise that these be the outside limits, as there is a possibility of careless workmanship that has escaped detection. I was once required by an architect to build the 3 in. partitions in a story 16 ft. high, he taking the responsibility. They were tested by severe shaking before the doors were put in or any plastering was done, and though very elastic we could not pull any of them down by hand, and they are

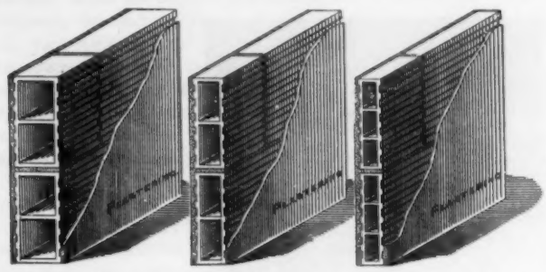


FIG. 3.

there to-day. The length of any one straight section of a partition is a more important element than its height, and judgment must be used in every case. I have built a 3 in. partition around two sides of an elevator shaft, 120 ft. high on girders in the cellar, the tiles being set on end; the weight at the bottom course was about 1,500 lbs. per lineal foot. This was only 94 lbs. per square inch of tile area.

It is customary in St. Paul and Minneapolis to build the partitions in office buildings, having stories 10½ ft. in the clear, with 2 in. porous tiles. The tiles are 8 by 12 ins. and abundantly strong when set in good mortar tempered with cement. When they want to cut out additional doors between rooms the carpenter does it with a saw. Two-inch partitions of hard hollow tiles have been recently built in Chicago. The same tiles are also used for wall furrings, and building out architectural shapes around columns, and boxing in pipes.

When book tiles were first used for roofs it was found that the same die would make a square partition tile which was very useful under certain circumstances. It was possible to give greater strength to long partitions without lateral supports by setting them on the side. The tiles, breaking joints, could be built up to a great length even without mortar. This led to making 4 in. book tiles for partitions. These have been used considerably in the Central States, but not at the East. An illustration is here given (Fig. 4). Another use was made of tiles of this section; wood blocks 1 in. thick were mill-worked to fit exactly between the joints of these tiles, and cut off to the length of the tiles. They were used only between tiles set in courses on end, wherever nailing was required. Thus, wherever there was to be wooden wainscoting, the first and fourth courses were set on end with wood blocks between which were as immovable as the tiles. These blocks should never be used in the joints when the tiles are set horizontally.

Two questions of importance are to be considered in setting partitions: the first is securing them to the walls and ceilings, and the second is the treatment of openings. The simplest and best way to secure partitions to brick walls is to drive large cut nails (not wire nails) into the joints of the brickwork on top of each course of tiles before setting the next course. The heads of the nails will then come between the courses. Cut nails are better in mortar or in porous tiles because they are of wedge shape. Nothing more than a few wooden wedges at the top is of any use. It is best to set partitions in the lower stories first and work upward. The weight of the partitions on each floor

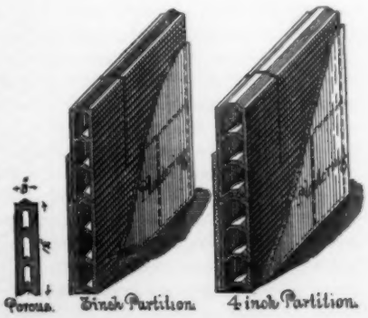


FIG. 4.

will add to the deflection of the beams of that floor, and thus bring pressure on the partitions of the floor beneath; while, if the partitions on the upper floor are set first, the setting of the partitions of the floor beneath it will pull them away from the ceiling. In buildings with wooden joists no dependence can be had on securing tile partitions at the top. They will always settle down and show a crack at the ceiling line unless they are set on steel beams. It is best for fire-proofing purposes in every case to set partitions after the ceilings are brown coated.

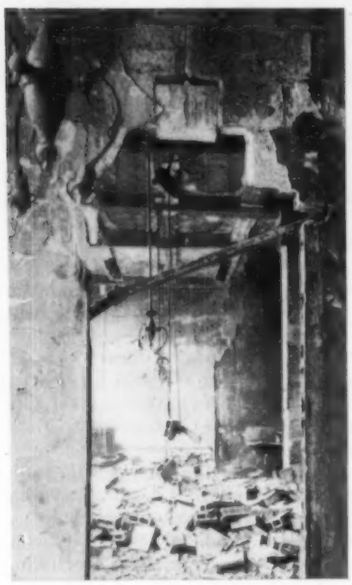


FIG. 5.

The greatest faults to be found in hollow-tile partitions are in the methods used for building doors and windows in them. First of all, the top of a door should always be covered with a flat end-pressure arch made of the partition material. As an example of how not to do this, see the half-tone from a photograph of a partition door in the Horne Office Building at Pittsburgh, taken after the fire in that building (Fig. 5). Here the tiles over the door have fallen down, while a natural arch has been formed by those that held their places. Where there are long rows of windows it is impossible to put in an arch. In such cases no expedient can be relied upon except to build a channel bar frame in each opening. It has been shown in repeated fires that all rough wooden frames are useless. If there must be finished wooden jambs, they should be screwed to steel jambs, but it would be better to hang all doors to steel jambs made of channels. The tiles can be built into them and their flanges will become grounds for the plasterer. An ornamental German steel rolled molding can be used to cover the joint. Where there are only occasional doors in the partitions and economy is desired, the rough wooden jambs can be secured in no better way than the simple one of driving two cut nails into their backs between the joints in the courses of tiles, and depending on the weight of the tiles on the projecting nail heads to hold the rough frames in place. These are better than angle cleats or anything else of the kind. No door studs should run to the ceiling. The tile partitions will always stand the racket if the door jambs are secured firmly to them. Experience has shown that no dependence can be placed in nails for securing anything to porous tiles, but wood screws are reliable.

Furring brick walls is a simple process that requires little comment. The best method is that shown in the illustration (Fig. 6). This shows porous terra-cotta plates 2 ins. thick and 12 ins. square.

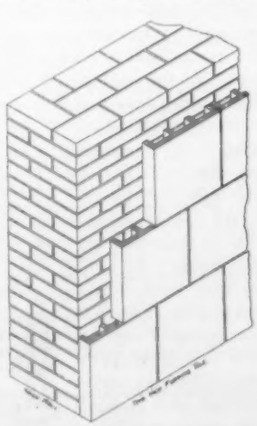


FIG. 6.

(Continued.)

Mortar and Concrete.

LIME, HYDRAULIC CEMENT, MORTAR, AND CONCRETE. VI.

BY CLIFFORD RICHARDSON.

THE ROSENDALE CEMENT INDUSTRY.

A GREAT anticlinal fold, extending along the valley of Rondout Creek from the Hudson River to the south and west for many miles, brings to the surface a series of cement rocks which is the source of the raw material for the great Rosendale cement industry; an industry which, as has been shown, supplies the Atlantic Coast with over three million barrels of cement a year, and which includes the mills of one company, alone able to turn out seven thousand barrels of cement a day.

The rock of suitable nature for cement making consists of two beds, one lighter in color than the other, which are separated by from 6 to 12 ft. of rock, not sufficiently argillaceous for making cement. The average thickness of the light rock is 11 ft., and the dark rock 21 ft. They are now quarried at a considerable depth below the surface, and obtained in a dense and unaltered condition. A collection of the rock from quarries, working at three different depths, made especially for the purpose in May, 1897, had the following composition:—

UPPER OR LIGHT STRATUM.

Density.	Nearest Surface.		Medium Depth.		Deepest.	
Coarser than 200 sieve	2.9		0.		.6	
Coarser than 100 sieve	2.3				.6	
Coarser than 50 sieve	1.7				.4	
Loss on ignition	38.00		36.90		37.72	
Insoluble in HCl	17.38		22.68		20.68	
Total Alumina and Iron Oxides	5.50		7.62		7.20	
Total Carbonates	80.10		72.70		75.80	
Carbonic Acid, Water, etc.	38.00		36.90		37.72	
Lime CaO, soluble	26.66		23.60		23.92	
Lime CaO, insoluble	trace		trace		trace	
Magnesia, soluble	15.00		13.70		15.06	
Magnesia, insoluble	.79		.88		.69	
Total		15.79		14.58		15.75
Alumina, soluble	1.04		1.88		.56	
Alumina, insoluble	2.94		3.80		3.52	
Total		3.98		5.68		4.08
Iron Oxide, soluble	1.52		1.20		1.96	
Iron Oxide, insoluble	.40		.74		1.16	
Total		1.92		1.94		3.12
Silica	12.72		16.66		15.14	
Sulphuric Acid	.68		.13		.09	

LOWER OR DARK STRATUM.

Density.	Nearest Surface.		Medium Depth.		Deepest.	
Coarser than 200 sieve	0.		0.		1.2	
Coarser than 100 sieve					.5	
Coarser than 50 sieve					.3	
Loss on ignition	33.84		36.28		34.60	
Insoluble in HCl	26.62		22.90		25.06	
Total Alumina and Iron Oxide	8.14		11.00		7.78	
Total Carbonates	70.20		66.50		73.30	
Carbonic Acid, Water, etc.	33.84		36.28		34.60	
Lime CaO, soluble	22.00		22.17		22.01	
Lime CaO, insoluble	trace		trace		trace	
Magnesia, soluble	13.90		12.07		13.15	
Magnesia, insoluble	.83		.79		2.98	
Total		14.73		12.86		16.13
Alumina, soluble	1.12		3.92		2.58	
Alumina, insoluble	3.68		4.38		2.26	
Total		4.80		8.30		4.84
Iron Oxide, soluble	3.34		2.70		1.72	
Iron Oxide, insoluble	.92		.86		1.22	
Total		4.26		3.56		2.94
Silica	18.40		16.22		18.48	
Sulphuric Acid	.17		.25		trace	

The hydraulic limestones of the Rosendale cement formation are seen to be somewhat variable in different localities and at different depths of the quarries from the surface. The upper or lighter stratum or bed is richer in carbonates than the lower or darker one, and, of course, poorer in silicates and oxides of iron and alumina. The nearer to the surface the quarrying is done the greater the amount of carbonates in the lighter stone, and the smaller the amount of silicates. This surface stone seems to be the most inferior in use. It is, however, mixed with the rock from the deeper quarries, having the most silicates, so that a proper average composition is obtained. All the cement rock contains much magnesia, from 15.06 to 12.07 per cent., but, fortunately, the silica and alumina are not, as a whole, deficient in amount, so that none of the strata are rejected. They

require careful combination and proper burning, however, and their composition being so variable should be frequently determined by analysis, as a control. The best cement produced from this rock may be regarded as the highest standard of what a natural cement should be.

BURNING OF NATURAL CEMENT.

Natural cement is burned in much the same way as lime. The kiln commonly used is the ordinary draw kiln, a structure of masonry lined with fire-brick, or an outer iron casing, or shell, enclosing a light brickwork the space between which and the fire-brick lining is filled in with sand or loam. These kilns are from 20 to 30 ft. high and from 8 to 12 ft. in diameter. They are arranged either singly, in pairs, or in banks, and have somewhat varied vertical sections. There is generally an increase in diameter from the top to a certain distance, and then a more or less gradual contraction to the throat, an opening at the bottom, or eye, through which the draught of the kiln is maintained and the burnt stone drawn.

The peculiar forms seen in practise are characteristic of the localities where they are used.

In some works flame kilns have been employed in which the combustion is carried on in furnaces outside of the main body, and the stone burned by the heat of the products of combustion. These kilns have no great application in the United States, as they require more fuel and more constant attention. Theoretically they are a much better form, as the finished cement is not mixed with the fuel ash, and the burning is more regular. The cement produced by them is found, however, not to be so much more satisfactory as to repay the extra cost.

Ordinary kilns hold enough stone to make from 300 to 600 barrels of cement of 300 lbs. each. They are charged with alternate layers of stone of suitable size, and coal. The size of the rock depends upon the ease with which it can be calcined, and the degree required for producing a good cement. It is at times uniform, or a certain proportion of finer material may also be added to prevent the too free burning of the kiln.

The proportions of fuel and stone vary very much. From one quarter to one eighth of the weight of the stone in coal is used.

The regulation of the temperature and time of burning is accomplished by varying the amount of coal, the size of the pieces of rock, the draught through the kiln, and the length of time between each drawing. The amount of coal and the draught are, of course, the principal factors in the burning. For hard burning more coal is used, for quick burning less, and more draught.

In burning the Rosendale cements there has been no change in the form of kiln since the early days of the industry. The old-fashioned draw or pot kiln is still in use, the eyes of two kilns opening into the same drawing pit, and the kilns being arranged in banks of six or more. The fuel is fine anthracite which is charged alternately with the rock, about 4 ins. of the former and 18 to 20 of the stone, which corresponds to about four and five tenths to five times more stone than coal in volume. Gilmore states that at the Ulster County cement works 3,500 lbs. of coal burns 30,000 lbs. of cement, which would be equivalent to over 40,000 lbs. of rock, and a proportion of over twelve times as much stone by weight as rock.

The kilns are drawn twice daily in the Rosendale district, beginning at 5 A. M., continuing until the rock gets hot, and again in the afternoon. At night the kilns are heaped up, and are burned down by morning. From 1 cu. yd. of rock nine barrels of cement are ground.

In the Potomac Valley and in the West bituminous coal is used in the same way. The custom there is to draw but twice a day, with the limestones free from magnesia, while at Fort Scott, Kan., small drawings are made every four hours. For each stone and each kind of fuel and form of the kiln the best proportions must be learned by experience, and it is not always possible to learn them from the manufacturers.

If the kilns are not properly charged and watched they may burn too quickly and freely, or, not having sufficient draught, the stone will be burned too little or unevenly, and the quality of the cement be inferior. Some rock, under careless regard of conditions, will be over and some underburned.

Finally, there is such a difference in the way various hydraulic limestones ought to be calcined that they should each properly be burned in separate kilns, where strata of different composition in the same quarry are in use, and the product then mixed in the most desirable proportions. Economy and carelessness, however, seldom permit of this refinement in practise.

TEMPERATURE OF BURNING.

What the suitable temperature and length of time of burning any particular stone may be depends on its composition as well as on its physical properties, density, and state of aggregation.

With a good stone, with medium percentages of clay, of fine grain and good density, a gentle and rather prolonged burning is best. The carbonic acid should be nearly, but certainly not entirely, removed from its combination as carbonates, yet no signs of sintering or clinker should appear.

When the insoluble part is more silicious than clayey, and especially when it is rather coarse, a very gentle and prolonged heat is the best to enable the lime to slowly combine with the silica.

When the insoluble matter is clay, and this is present at all in excess, a sharp, quick heat is found most desirable. The higher the amount of insoluble matter or silicates in a hydraulic limestone the more carefully it must be burned and the lower the heat must be. Rocks of this class, when overburned, are liable to crack and blow on setting.

When magnesia is present in large amount the rock can be burned in two ways, either below a red heat sufficiently to expel the carbonic acid from the magnesian carbonate, and to a smaller degree from the calcium carbonate, which gives a cement of considerable hydraulic activity; or it may be very strongly burned until the hydraulic activity of the magnesia is destroyed. The latter method is seldom or never followed in practise, as it is difficult to regulate and not universally applicable.

The smaller the amount of clay and silica in magnesian rocks the more moderate must the burning be, until finally a dolomite with no clay is reached, which, with light burning, will yield a mixture of magnesian oxide and carbonate of lime which has very considerable hydraulic activity.

Magnesian cements deficient in clay, which approach hydraulic limes, if not burned carefully, are, however, very apt to expand a long time after use.

In the Rosendale limestones of Ulster County, New York, a suitable amount of clay is found, and this, together with the density of the rock, gives the cements made from them their desirable properties, as distinguished from the Western New York cements, which are, most of them, scarcely more than hydraulic limes.

CHEMISTRY OF BURNING.

In the process of burning cement stone the rock, at a low temperature, is dried out. At about 750 degs. Fahr. it begins to lose carbonic acid, although a continued bright-red heat is necessary for the complete conversion of the carbonates to caustic lime and magnesia. A porous stone burns much more easily than a very dense one. The best hydraulic limestone requires, therefore, longer burning than the inferior material. The rate of burning also depends on the size of the fragments and upon the rapid removal of the carbonic acid from the kiln, as in ordinary lime burning. The amount of clay or silica in the stone has also an influence; the more of these substances present, the more difficult the burning.

When the carbonic acid has been driven off in part the free lime, at the high temperature, attacks the clay and silica, combining with them to form new compounds having hydraulic energy and rendering them soluble in acid, although previously insoluble. The heat, however, in the process of natural cement making is not great

enough to bring about the combination of the entire amount of lime present with the silica and clay, as in the case of Portland cement. A certain amount remains uncombined, both free and as carbonates, and the silicates and aluminates are not as basic, lime and magnesia not being present in these compounds to their full capacity, as they are in the artificial cements, where as much lime is combined with the silica and alumina as is possible, to form very basic compounds.

Some free lime, and generally carbonates, are therefore present in natural cement, and are characteristic of it.

If too great a heat is used in burning, approaching that employed in the Portland cement manufacture, compounds are in most instances formed which have no hydraulic value unless the proportions of the various constituents in the stone are approximately those required for that class of highly burned artificial cements known as Portlands, when such a substance may be formed. In the presence of too much clay overburned natural cements contain very unstable compounds which, while they may at first set on addition of water, check later and fly to pieces.

When there is an excess of certain elements in limestone, such as alkalies or sulphates, these substances may enter into the reactions of the burning process and complicate it, as they have a tendency to form with ease compounds of ready fusibility. Rocks of such composition are unsuitable for use.

ILLUSTRATIONS OF RESULTS OF BURNING.

The peculiarities which have been mentioned may be illustrated by some particular cases.

No. 1. A Lime Cement. This cement when freshly made had the following composition: —

Loss on ignition, carbonic acid, and water,	10.27
Silica and silicates, not decomposed by burning,	9.80
Silica combined with lime in burning,	20.42
Alumina and iron oxide,	13.76
Lime,	39.54
Magnesia,	3.80

This cement, burned from a stone comparatively free from magnesia, as ready for use, loses only about 10 per cent. of its weight on ignition, consisting of water, with which the freshly burned stone was sprinkled to lengthen the time of setting, and of carbonic acid, which shows that the burning was thorough. The silicates have not, at the temperature employed, all been decomposed and become combined with lime, but very much the largest part has done so. There is an ample amount of alumina, all of which has been converted into compounds of hydraulic value in the kiln. This cement is an excellent example of this type of natural lime cements.

Tests for tensile strength gave the following results: —

Neat at	1 day	150
	7 days	440
	28 „	452
2 parts quartz	7 „	244
	28 „	276

It acquires strength rapidly in the test pieces in seven days, and would be found to increase slowly for one or two years thereafter. In actual use, with larger quantities of water in the mortar, it would of course attain its strength more slowly.

No. 2. A Blowing Magnesian Cement. This cement, when made into briquettes and immersed in water, checked and blew to pieces in a few days. The difficulty is revealed by the following results of an analysis: —

Loss on ignition, carbonic acid,	7.44
Silica and silicates, undecomposed,	17.09
Silica combined,	10.88
Alumina and iron oxide,	13.26
Lime,	38.69
Magnesia,	9.64
Sulphuric oxide,	.95

The burning, it appears, has been so conducted that, while carbonic acid had been largely driven off, the temperature was too low to permit of combination of the free lime with the silica, although unstable alumina compounds had been formed. The cement, therefore, blows. On reburning it, at a higher temperature, for a short time a normal magnesian cement was obtained. It contained then but 3.70 per cent. of carbonic acid, and but 4.70 per cent. of undecomposed silicates. This cement gained strength slowly but regularly, and, when properly burned, has been largely used in concrete with great success.

Tensile strength tests resulted as follows: —

Neat at	1 day	82
	7 days	102
	28 „	252
	3 months	340
	6 „	358
2 parts quartz	7 days	59
	28 „	120
	3 months	238
	6 „	288

No. 3. A Magnesian Cement Deficient in Clay. This cement gave very low results on testing for tensile strength for the first few days after mixing, but soon gained rapidly, expanding, however, very considerably at a greater age. Its composition was as follows: —

Loss on ignition,	6.00
Silica and silicates undecomposed,	4.48
Silica combined,	13.06
Alumina and iron oxide,	5.01
Lime,	41.79
Magnesia,	29.60

The cement is plainly deficient in silica and alumina and contains a very large amount of magnesia. It has been burned, apparently, quite hard, and is practically merely a dolomite cement which is weak at first, and afterwards, although attaining very considerable strength, expands. To obtain the best results with this cement it was, of course, necessary to burn it quite hard. The results of tests for tensile strength were as follows: —

Neat at	1 day	36
	7 days	230
	28 „	400
	6 months	Expands
2 parts quartz	7 days	130
	28 „	300
	6 months	Expands

This cement is used successfully for much work where the expansion in sand mortar does no damage, but it is hardly satisfactory to use such material.

HARDENING AND DETERIORATION OF LIME MORTAR.

BY H. K. LANDIS, E. M.

IT frequently happens that specifications are very rigorous in their requirements for the character of sand employed in mortars containing the best grade of lime, and very exacting in the proportion of sand to be used. This is probably due to the antiquated idea, held by some, that the sand actually combines with the lime and forms large proportions of silicate of lime. It is a fact that silicate of lime is formed in lime mortars, but not in quantities sufficient to make it the predominant factor in hardening of mortar. Petzholdt found two thirds of 1 per cent. of the quartz sand added to lime had combined with it in five weeks, while but one tenth that amount was found combined at the end of one week. In a wall one century old 2.1 per cent. of combined silica was found, while this was increased to 6.2 per cent. in a mortar three hundred years old, although the original lime contained but 0.11 per cent. combined silica. The

hardening effect of this silicate of lime is, however, insignificant when compared with the total hardening of lime mortar, for after several years there will be but half a per cent. of silicate of lime in the mortar.

This silicate is not very stable because carbonic acid, a comparatively weak agent, displaces it. Moisture favors the formation of silicate of lime, so that its formation begins from the time the mortar is mixed, and is comparatively rapid until the lime mortar has dried; then carbonic acid gas begins to act, and as numerous observations and analyses have shown, really displaces the silicate with carbonate, for scarcely a trace of silicate is found among the carbonate; it, however, exists in the interior where the gas has not yet penetrated.

The mixture of sand with lime is thus not the necessary condition of hardening, for hard mortars can be obtained by mixing finely ground limestone or chalk with the lime. Its functions lie more particularly in making the mortar more porous, thus permitting easy access of carbonic acid gas in counteracting the effects of shrinkage, and in reducing the cost of mortar.

Sand should be free from earth, dust, clay, or iron rust in order to permit the close adhesion of lime to it; this action is mechanical. It should be angular, as the mortar is thus not so liable to fracture along a smooth plane, which is thus one of greater weakness; angular masses knit together and bind each other, and are also more elastic; the sharp edges of the silica sand do not form silicates to any noteworthy extent. The particles should be uniform in size and not too coarse, in order to avoid the occurrence of flat surfaces in the section of mortar which would be large enough to weaken the mortar itself, because the cohesion of lime for itself is greater than its adhesion to any large surface. Thus far a specification can reasonably go.

Not all mortars are equal setting; some become solid in a few days, while others will not be completely hardened in a century. When fresh mortar is exposed to the air it first loses part of its water, then begins to take up carbonic acid gas, which is given out by animals, and by vegetable combustion, and has its hydrate of lime changed to carbonate of lime. This absorption takes place gradually, from the surface inward, and usually does not begin until the mortar has set; it is found that the proportion of water in fresh mortar — about 50 per cent. — is strong enough to prevent the formation of carbonate of lime, and to prevent the absorption of gas. If we place fresh mortar in a glass tube and fill it with carbonic acid gas, the mortar will be unchanged after many days, and the quantity of gas absorbed will be insignificant, while the same mortar exposed an equal time in air will have absorbed considerable gas.

Suspend in a flask filled with carbonic acid gas samples of fresh mortar. At the end of a week it will be as moist as when put in, and will have absorbed less than 1 per cent. of its weight of gas. If, now, a dryer, such as strong sulphuric acid, is placed in the bottom of the flask, the same samples of mortar will absorb the carbonic acid gas in the flask at the rate of about 14 per cent. per day. A number of other experiments may be performed to show the same fact. If, however, we dry the mortar completely we obtain a very compact but very friable mass. Duquesnay says that in this state the mortar does not harden and absorbs no carbonic acid gas. A certain amount of moisture is thus necessary in the mortar.

The formation of carbonate of lime is favored by drying slowly after setting, and this also favors the cohesion of the hydrate, since the particles which solidify first are surrounded by a solution of lime which on drying leaves its lime on the outside of these particles and cements them together just as the grains of sand are cemented together in the formation of sandstone; this cementing is the more complete as the drying is slower, and thus one can explain the extreme solidity of masonry of the middle ages, which now must be blasted in removing.

Gas penetrates smooth surfaces more slowly than rough ones; in fact, the character of the surface exposed to the air has a very strong influence. In a block of lime which was examined chemically at the end of a year, the depth to which carbonation had penetrated on a trowel-finished side, a rough-finished side, and a side which had been broken off, was in the proportion, respectively, of 3 to 7 to 14, half the surface of a cross section being unaffected. This would indicate that the usual method of smooth finishing joints is not the best.

Deterioration in mortars has numerous causes which depend upon both outside conditions and the character of the mortar itself. It is assumed that stone and sand shall be used, which will be unaffected by the ordinary agencies with which it comes in contact. Precautions are easy to observe in this regard, but when we come to lime it is not so easy to prevent alteration. Lime is soluble in water, and if exposed to a current will be taken up by the water quite rapidly. When the mortar has somewhat hardened in air and is then exposed to still water the effect is inappreciable, for the lime is protected by a superficial coat of carbonate, and not only resists the dissolving action of the water but attains to considerable hardness.

Nitrogenous matter, such as manure or urine, can produce nitrates of lime under certain conditions of moisture and temperature. This salt deposits as snow-white accretions on the stone or as a superficial layer on the mortar, and sometimes resemble flakes of snow. Such salts are used in the chemical industry; their production should be discouraged, as they have a deteriorating effect on the masonry, making it liable to crumble.

Efflorescences of another kind often appear on the surface of the walls, such as sulphate of soda, carbonate of soda, chloride of sodium, carbonate of potash, and chloride of potassium, which contain the constituents of neither stone, brick, nor sand, and are hence attributed to the kind of lime used in the mortar. The presence of alkalies is explained by their existing in the original limestone before calcination, or that they are derived from wood and coal ashes which contain considerable quantities of alkalies; sometimes soil alkalies are brought in by surface waters and disperse through the walls, leaving a white deposit on the surface when they evaporate.

Ammoniacal fumes are given out by many industrial operations, as when tobacco waste is burned in fireplaces along with coal or coke; the latter furnish sulphurous vapors derived from the oxidation of iron pyrites in the coal, which combines at the top of the chimney with condensed water vapor and ammonia gases, forming sulphate of ammonia; this liquid in a short time causes the mortar to disappear entirely. The use of salty water for slaking lime or mixing mortar causes the formation of chloride of sodium and carbonate of soda (common salt and washing soda), which absorb moisture readily and tend to constantly keep the walls damp.

THE ELECTRIC CONDUCTIVITY OF CEMENTS AND BETONS.

IN a very interesting series of experiments made by Dr. Lindecka and described in the *Electrotechnische Zeckschrift* a considerable amount of new information was brought to light.

He found that the electric resistance of a cubic foot of cement, when dry, was about 144 ohms, which fell to 43 ohms after 24 hours' immersion in water, while it rose to 820 ohms when exposed to a temperature of 212° Fahr.

Sand and gravel increase the electrical resistance one part of cement to seven of gravel in a block having a resistance of 18,000 ohms, which fell to 72 ohms when the blocks were wet, or rose to 2 megohms at 212° Fahr.

If we allow for concrete an average resistance of 1,670 ohms per cubic foot, one obtains an insulation resistance of about 1.2 ohms per thousand. In asphalt paving the loss of current through the asphalt is very small, so that where conductors are laid directly in the concrete they should be surrounded with asphalt cement. This cement is usually made, one half broken stone; gravel, free from clay or sand, 20 per cent.; asphalt, 12 per cent.; tar, 8, and mineral oil, 10 per cent. These figures are important, not only as showing how current may be saved, but also in pointing out the conditions under which cement insulation may become a dangerously good conductor.

The Masons' Department.

HOW SHALL THE VALUE OF EXTRA WORK BE DETERMINED?

THE most irritating and troublesome questions which the architect and contractor are called upon to consider are probably those of determining the value of extra work or work omitted. The zeal which the architect often displays in the interest of his client on the one hand, and on the other the pernicious habit of many contractors who take work at cost or below and depend on changes to make their profit, are perhaps equally responsible for the trouble which ensues. It takes comparatively little experience to absolutely prove that almost no building contract is carried to completion without more or less changes from the original scheme. And the alterations made from time to time, which affect the progress of the work, must of necessity be ordered without delay and in accordance with the terms of the contract. The natural result of this is that very little time is afforded the architect to verify the propositions of the contractor, and the necessary haste often tends to encourage arbitrary action. While most all building contracts at the present time provide for an appeal from the decision of the architect by either of the parties concerned, and the reference of such questions to three arbitrators, such a course is rarely taken. The complexity of the architect's duties makes it impossible for him to keep more than generally informed as to the value of the various work and materials which enter into the construction of a building, and he must, therefore, adopt one of two courses to obtain the information which is necessary for him to possess in order to fulfil his obligation to the client on one side and the builder on the other; the first is to arrive at a conclusion from personal observation and experience; the other is to obtain the desired knowledge from experts, that is to say, those who are engaged in the same sort of business in regard to which the question arises. Each of these courses have their own peculiar disadvantages. In the first instance, the architect is usually inclined to undervalue, for the simple reason that it is almost impossible for an outsider to appreciate the amount of detail which goes to make up the cost of labor and materials connected with any given piece of work. If, on the contrary, he seeks expert advice, what may be broadly defined as "professional courtesy" prevents his getting at the bottom facts, or else, for some reason, the person to whom the matter is referred takes the opportunity to even things up or pay off an old score by giving prices unreasonably low. The simple truth is that the position of the architect, when called upon to determine what is a fair value for the work of a contractor, is one which is extremely difficult to fill with any degree of satisfaction to both of the parties concerned. This fact has led some architects to insert a clause in their contracts making the architect the sole judge of the value of work and materials, with no appeal from his decision. This arbitrary method can hardly be defended as quite just or reasonable, but one is sometimes inclined to believe that even a solution as absolute as this is preferable to the discussions and irritations of a less severe method; for under this plan the matters can at least be settled promptly and once for all, which in some ways has an advantage over the usual manner which so often involves perhaps a greater loss in the way of delays than would be suffered by the arbitrary decision of the architect. There can be no question that, if some method could be devised by which the value of extras could be settled both promptly and fairly, the builders who figure to do work exactly as called for, and include in their original estimate a fair and reasonable profit, would be much more likely to be successful when in competition with those who pursue the opposite course. There are very few architects of standing who would not prefer to give their work to the former class, but the apparent saving by the acceptance of a low bid is usually too much of a temptation to the client, who cannot be made to realize the economy of a just discrimination until he has paid out much more than the original saving in overvalued extras and undervalued omissions.

The satisfactory solution of this problem seems at first thought a difficult matter, but in reality it probably presents no more serious complications than many other questions which have been met and settled. With the knowledge which both architects and contractors have on this subject, it is to be hoped that their organizations will realize the importance of instituting a reform in this direction.

CONTRACTOR.

EDITOR OF THE BRICKBUILDER.

Dear Sir: — May I trespass on your valuable space to ask for a bit of advice? I am erecting a building of which the first story is stone, and the upper stories of brick and terra-cotta. For constructive reasons the masonry should be laid up in cement, but I do not dare to risk the staining which cement is so apt to impart to the stonework. I have been advised to put a certain amount of sugar in lime mortar and use the mixture instead of cement, and I have been told that the addition of sugar to lime mortar will produce a species of cement which will set up very nearly as hard as if hydraulic cement were used. Is this true? Can you give me any idea as to the proportion of sugar to use? And whether there is any liability of the mortar staining the limestone? I was advised by the mason to cover the back of the stonework with asphalt, but I hesitate to do so, fearing that the oil in the asphalt would work through and stain the stone. Is there anything else which can be used to advantage to prevent the moisture of the cement from the brick backing working out through the stone?

Also, in regard to the terra-cotta, it is to be what is commonly designated as white terra-cotta. In the last building upon which I used this shade of terra-cotta I find that the surface of the material is stained somewhat, and though the building has been finished for over a year, the individual blocks are not of the same tone, and none of them have come back to the color they presented before the work was set in the building. The terra-cotta was laid up with mortar composed of lime, with a very small proportion, I think one sixth in bulk, of Rosendale cement. I am afraid to use cement in the new work. Why should the light terra-cotta stain, or, why should it not regain its original color when dried? I feel that facts of this sort are pretty vitally connected with the use of terra-cotta, and should be glad of any advice you could give me. ARCHITECT.

IN regard to the staining of stonework, Lefarge cement, it is claimed, will not stain the stone at all, but any other cement which is on the market at present, with which we are familiar, is liable to produce discolorations. The value of sugar as a component of lime mortar is an unknown quantity to us. It has been used repeatedly, but we are unable to give any exact information as to the quantity necessary to produce the best results. The value of sugar as a component of lime mortar lies in the fact that sugar unites with a portion of the lime, forming saccharate of lime, which is considerably more soluble than the ordinary hydrate. Consequently, the resulting mixture will form a more intimate bond with the sand.

In regard to the staining of terra-cotta, it may come from one of several causes. We do not believe that cement can be trusted in any quantity in the mortar which is to be used for setting up light-colored terra-cotta. Even one sixth might produce permanent stains. Another cause of possible stains is due to the terra-cotta being improperly packed in soiled material. We know of one case where straw was used which had been taken from a stable where it had served as bedding for horses, and the owner of the building in question was for a long while at a loss to account for the vile yellowish stains which appeared on his terra-cotta. We believe, however, if pure lime mortar, the lime for which has been slacked at least three weeks before being used, is employed with clean, sharp white sand, and proper care is taken in the handling and setting, and nothing but pure water is used to clean off the surface of the terra-cotta, there will be no stains whatever on even the most delicate shades.

The use of iron ties is not advisable in connection with terra-cotta if extreme precautions are to be taken. Nothing better has so far been found than copper for this purpose, and if iron is used, even when thoroughly galvanized, it is liable to rust; and a very slight amount of oxide of iron is capable of producing serious stains in the terra-cotta.

It must be remembered that it is not enough to lay up the terra-cotta itself with mortar from which the cement is excluded, but the brick backing must equally be kept free from the disturbing influence, for it has been found that the staining qualities of the cement will penetrate through several courses of brick and affect the exterior surface of the terra-cotta. Furthermore, it is bad construction to lay up the backing of a wall with a different mortar than the front. The matrix ought to be the same in each case to insure equal shrinkage of the joints and to preserve the alignment of the wall.

We refer the questions of our correspondent to our readers, and would be glad to receive any information on the subject. EDS.

QUANTITY OF MORTAR REQUIRED FOR A THOUSAND BRICK.

A WRITER discussing in one of our exchanges the quantity of mortar necessary to lay 1,000 brick, states that this is a point on which knowledge is essential before one can properly estimate the cost of brickwork. He says that the proportion will vary with the size of the brick and with the thickness of the joints. With the standard size of brick, which are 8¼ by 4 by 2¼ ins., a cubic yard of masonry laid with ½ to ⅝ in. joints will require from .35 to .40 cu. yd. of mortar; or 1,000 bricks will require .80 to .90 cu. yd. If the joints are ¼ to ⅜ in. thick, a cubic yard of brickwork will require from .25 to .30 cu. yd. of mortar; or 1,000 bricks will require from .45 to .55 cu. yd. If the joints are ⅛ in., as for pressed brickwork, 1,000 bricks will require from .15 to .20 cu. yd. of mortar. It should not be difficult for an estimator to be able to tell exactly the cost of the matertals required to build up 1,000 bricks in a wall, having the cost of bricks, sand, and lime at hand, including hauling, with the above data before him. It is a little difficult to tell exactly how many bricks a man will lay in a day of nine hours, as conditions vary, and some men are much more expert than others; but if well supplied with materials, and no scaffolds to adjust, and a long wall to work on, 1,500 bricks would make a good average day's work. If, however, there are many openings to work around, and neat facing to do, from 900 to 1,100 will make a good day's work. In good ordinary street fronts from 700 to 900 may be counted, and in the finest street work, where there are numerous angles, doorways, or belting courses, from 150 to 250 may be considered a good day's work. In large works, or where walls are very thick, a good man will lay from 1,500 to 1,800 bricks, but this is rather the exception than the rule. A good laboring man will mix mortar and carry it and bricks for the bricklayers, if mortar and bricks are not more than 25 ft. from the building, and provided he does not have to carry water or climb a ladder. As the brickwork of a building rises, so does the cost. Whatever may be the figures obtained as the cost per 1,000 of laying bricks for the first story, 5 per cent. should be added to it for laying the bricks for the second story, and 12½ per cent. for the third story, and a corresponding percentage for the work laid in higher stories.

SURETY ON BOND OF CONTRACTOR.

WHERE a building contract provides as a condition precedent to the final payment that there shall be no legal claims against the contractor for work or materials furnished, a surety on the bond of the contractor cannot enforce a lien for work or materials. He cannot be permitted to recover without violating his contract of suretyship, and he must therefore be held to have waived the right to file any lien in the face of his contract. — *Supreme Court of Pennsylvania.*

Recent Brick and Terra-Cotta Work in American Cities, and Manufacturers' Department.

CHICAGO. — Foundation walls are being constructed for a church which promises to be a very interesting piece of brick architecture. The designs of the architect, Mr. H. J. Schlacks, show the extreme dimensions of the building in plan to be about 108 by 203 ft. The style is denominated by the architect "late Romanesque Gothic." The plan is a modification of the general Gothic type of the middle ages. The nave is 40 ft. wide between piers, while the aisles are narrow, and having no seats, serve for aisles only.

The foundation walls are of rubble stone and rest directly on natural rock 15 ft. below grade, the same stratum which is more than

TERRA-COTTA PANEL, MISSION LODGE HALL, SAN FRANCISCO, CAL.
Hermann & Swain, Architects.
Executed by Gladding, McBean & Co., San Francisco, Cal.

100 ft. under sand and clay at the business center of Chicago, five miles from this St. Paul's Catholic Church, which is located at 22d Street and Hoyne Avenue. All the walls are stone up to and including a granite water table 18 ins. above grade. Above this water table all the walls are to be brick, built hollow. The entire exterior and interior, including vaulted floors and the lofty vaulted roof, are to be faced with special brick and terra-cotta of various colors. Several large finial crosses are to be terra-cotta, and copings and other trimmings will be of the same material. The splay molded sills and jambs of windows both outside and inside, the buttress caps, etc., and the vaulting as well as the plain wall surfaces are all to be of fire-clay stiff mud brick repressed and vitrified. The full-size diagrams of all these brick are being made in the architect's office. There are probably fifty different special shape brick. The standard adopted for a finished brick is 4⅛ ins. by 8⅜ ins. by $2\frac{7}{8}$ ins., the vertical mortar joints are allowed ⅛ in., and the horizontal joints $\frac{3}{16}$ in. The archi-

TERRA-COTTA DETAIL, HUDSON BUILDING, 32 BROADWAY, NEW YORK.
Clinton & Russell and A. F. Leicht, Architects.
Executed by the White Brick and Terra-Cotta Company.

QUEEN INSURANCE COMPANY BUILDING, BROADWAY, NEW YORK CITY.
Geo. Edw. Harding & Gooch, Architects.
Face brick supplied by Sayre & Fisher Company.

tect's aim has been to make the building look what it is, a brick building, and in designing the terra-cotta ornament care was taken that it should not be an imitation of carved stone.

All the work is to be laid in imported Portland cement mortar. The piers carrying the vaulted roof are solid construction, not iron columns veneered with terra-cotta. Massive walls, instead of being filled with useless concrete, are hollow, carefully laid with thickness proportioned to imposed loads. The result ought to be both strength and economy. As for color, the exterior is to be a mottled mahogany, while the interior is to be treated in light shades of buff mottled, and with the mahogany color for trimming. Bricks are being delivered on the ground now.

The design shows a simplicity and beauty of composition, and yet a building so large and imposing that one thinks he is looking at a cathedral costing a half million of dollars. Imagine, then, one's astonishment when assurred by the architect that the church will be constructed and completed for $75,000! It might be added that the construction of this building is intended to be as nearly fire-proof as possible. The door frames are iron, while windows are minus frames and sash, the glass being set directly in the brick.

Work on the new government building has begun in earnest and is being pushed seven days in the week, and nights as well. This great excavation, a block square, busy with men, teams, and pile-driving apparatus, is now the center of all eyes in Chicago.

The Governor of Illinois has appointed the examining board of architects, the members being Mr. D. Adler, Mr. P. B. Wight, Prof. N. C. Ricker, Mr. Wm. H. Reeves, and Mr. Wm. Zimmerman. The effectiveness of the new law will depend in great measure on the efforts of this board.

In the way of building items we note: A mill and warehouse $160,000, by Flanders & Zimmerman; a factory, $50,000, by J. H. Wagner; a fire-proof office and theater building, by Inland Steel Company, $65,000; Wells-Fargo stable, $75,000, by M. L. Beers; Dormitory at Beloit, Wis., $30,000, by Patton & Fisher; Lehman apartment house, $200,000, by E. R. Krause; a row of twelve stone houses, $90,000, by H. L. Ottenheimer; apartment building, $25,000, by Pond & Pond.

NEW YORK.—That the immediate outlook for prosperity, or at least better times for the building and real estate trades, in this city is near may be inferred by the observant in connection with two very important kinds of transactions which have been the features of the past month.

The first is the selling of private houses to those who will occupy them. This is the healthiest sign that has shown itself in the real estate market in months. Purchases of this kind mean that small investors in considerable numbers have entirely recovered confidence and are ready to do business. The few sales already closed will inspire hesitating buyers to come forward with some assurance, and with the great improvement in general trade, and the splendid condition of the stock and grain markets, there cannot but be, at least, the beginning of an active fall season.

The second line of sales is not so gratifying. One of the leading New York papers is authority for the statement that New York has an oversupply of many kinds of structures. Flats and tenements there are in plenty, as thousands of vacancies testify, and in small low-priced dwellings the demand hardly equals the supply. Looking back on the work of the past spring and summer, the casual observer would naturally think that the architects must be very busy; but on investigation it is found that this large work is, as is perfectly proper, entrusted to those few who have attained a reputation for carrying on work of that kind, while it is a fact that those men whose special study is smaller work, residences, etc., are not terribly overworked, and there are still draughtsmen looking for jobs, which will probably be forthcoming to those who are worthy. Among the recent items of news are:—

A fifteen-story office building at 35 Broadway for the estate of A. Hemenway. It will be a

TERRA-COTTA DETAIL, PRESBYTERIAN BUILDING, PHILADELPHIA, PA.
Jos. M. Huston, Architect.
Executed by the Conkling, Armstrong Terra-Cotta Company.

brick building and will cost $800,000. Clinton & Russell are the architects.

The Medical Society of the county of Kings are holding a competition for a new club house to be erected on Bedford Avenue, Brooklyn, at a cost of $50,000. Drawings are due September 20. The building committee has appointed Frank Freeman, a practising architect, to be their professional adviser. This is not usually considered proper practise; but in this case we can assure competitors of fair treatment, as the architect mentioned is one who holds the honor of this profession above all thoughts of personal gratification.

A five-story brick business building will be erected on Prince Street, corner Marion, to cost $50,000. Richard Berger, architect.

Howard & Cauldwell, architects, have made plans for a $20,000 addition to the Ladies' Christian Union Building, 27 North Washington Square.

George Keister, architect, has planned a $40,000 addition to an eight-story brick and stone business building for Mr. J. B. Cole.

G. F. Pelham, architect, has made plans for a five story brick apartment house on Amsterdam Avenue, to cost $70,000.

Edward Wenz, architect, has planned three five-story brick flats and stores to be erected at Lenox Avenue and 113th Street, at a cost of $95,000.

M. J. Garvin, architect, has planned two five-story brick flats and stores to be built on 171st Street. Cost, $55,000.

Henry Anderson, architect, has planned a flat building to be erected on 115th Street, corner Seventh Avenue, at a cost of $90,000.

Neville & Bagge, architects, have planned five five-story brick flats to be erected on 115th Street, near Lenox Avenue, at a cost of $115,000.

C. B. J. Snyder, architect, has prepared plans for a five-story brick public school, to cost $220,000.

ST. LOUIS. — The revival of business throughout the entire West, and the improvement in local realty circles, although not affecting the architects much as yet, offers considerable encouragement, and it seems to be the feeling with every one that next year will be a busy one, and that work will commence early in the season.

During the last few months there has been a gradual increase in the value of the improvements that have been made, which have been of the character of flats and small residences in the outlying districts, but now the improvement or alteration of business houses, and the building of additions to factories, seems to be attracting considerable attention. Many of these improvements are of considerable importance; as, for instance, the alterations in the Southern and Hurst hotels, the erecting of a $90,000 factory by the Curtis Manufacturing Company, a $100,000 plant by the Brecht Ice Machine Company in North St. Louis, and a large ice factory by the Anheuser-Busch Brewing Company.

Work has also been commenced upon several buildings where it was suspended last year on account of money matters.

John Conradi is the architect for the new Deutches Theater, which is being built on Broadway, between Market and Walnut Streets, at a cost of $40,000.

The transfer of 107 ft. of land on the north side of Washington Avenue between 9th and 10th Streets, and extending through 225 ft. to Lucas Avenue, was recently made, and it is reported that improvements in the way of a large wholesale house to cost nearly half a million dollars will be made. The building is to be occupied by the Hagardine-McKittrick Dry Goods Company, and work is to be carried on night and day to have it ready for occupancy by the first of May. Eames & Young are the architects. This location is fast becoming the center of the wholesale

DUNN BUILDING, BROADWAY, NEW YORK CITY.
Geo. Edw. Harding & Gooch, Architects.

RESIDENCE AT MADISON, N. J.
Boring & Tilton, Architects.

dry goods and boot and shoe trade, and other improvements are under consideration.

The Barnes Medical College will open their school year in their new building on Chestnut and 31st Streets, which they have recently completed. The building is five stories and basement, in the Italian renaissance style of architecture. Buff brick and white stone have been used in the exterior. J. B. Legg was the architect.

TERRA-COTTA DETAIL, MAIN ENTRANCE, ST. JOHN'S CHURCH, JOHNSTOWN, PA.
Beezer Bros., Architects. Made by the Standard Terra-Cotta Company.

PITTSBURG. — The outlook for building during the fall is far more promising than it has been for several years. So great has been the demand for building permits, and so decided and general the opinion that building operations will assume vast proportions in the near future, that property has been affected in all sections of the city, and values will naturally be enhanced materially. Preparations and plans are being made for the erection of a market house in the East End, by a new corporation, under the title of "The Liberty Market." $200,000 will be spent; steel framing, Pompean and white enameled brick will compose the structure, and all modern improvement and convenience will be installed. A charter was issued at the State Department at Harrisburg for the Bellefield Company of Pittsburg, which proposes to erect a hotel near the entrance of Schenley Park. The capital stock is $300,000. The plans have been prepared by Architects Rutan & Russell, for a modern building in every particular.

Architects Vrydagh & Wolfe; Struthers & Hannah; J. L. Beatty; Bartberger & East; and E. E. Miller, have submitted sketches for the U. P. Shadyside Presbyterian Church.

Architect Charles Bickel is receiving bids for the erection of the Majestic apartment house, at Butler and 35th Streets, for Capt. M. A. Cutter, to be five stories, pressed brick and terra-cotta.

Architects Vrydagh & Wolfe are preparing plans for a brick colonial residence for W. L. Smith on Morewood Avenue, to cost $10,000.

Architect J. N. Campbell is preparing plans for a $10,000 buff brick colonial residence at Crafton for James McAleer, Esq.

Plans are being prepared for a new school building for the 10th ward, Allegheny, to cost $125,000.

Architects Rutan & Russell are preparing plans for a hotel at Sewickley.

George Booth, of the Department of Charities, has had plans prepared for a brick building for children at the poor farm at Marshalsea.

Architect J. E. Obitz is preparing plans for a brick church to be erected at Tarrentum for the Trinity Evangelical Lutheran congregation.

Architect U. J. L. Peoples's plan for the new high school at McKeesport has been accepted.

NEWS FROM THE BUSY.

THE Pioneer Fire-proof Construction Company, of Chicago, have taken a new suite of offices in the Marquette Building.

IN our last month's Boston letter, it was reported that Mr. George B. Rogers was the architect of the new Times Building, at Hartford. We have since learned that Mr. A. W. Scoville is the architect of the building, Mr. Rogers being in his employ as draughtsman at the time that the plans were being made.

MERCANTILE BUILDING, ST. PAUL, MINN.
Cass Gilbert, Architect.

CHARLES T. HARRIS, Lessee, will supply the Celadon roofing tiles for the following new buildings: —

Residence for N. W. Bowen, Delphi, Ind.; Dauphin Park School Building, Chicago, Ill.; residence for Mrs. A. H. Armour,

RESIDENCE AT PITTSBURG, PA.
Alden & Harlow, Architects.
Face brick manufactured by the Harbison & Walker Company.

RESIDENCE AT MADISON, N. J.
Boring & Tilton, Architects.

Kansas City, Mo.; Railroad Station, at Franklin, Penn.; Biological Building, Columbus, Ohio; Susquehanna Avenue Church, Philadelphia, Penn.; residence, Newark, N. J.

WE have had sent us by the Powhatan Clay Manufacturing Company, a sample of their new silver-gray brick. In shade and texture it is an ideal brick which shows that same excellence of manufacture that has made the cream-white brick, made by this company, so popular.

THE "Brooklyn Bridge" brand cement was specified on the thirty-story office building, on Park Row; R. H. Robertson, architect; John Downey, general contractor; Dawson & Archer, masons. The latter have adopted this brand of cement, and it will be the only Rosendale cement used in the construction of what will be the largest office building in the world. It may be also stated that this brand was the only Rosendale cement used in the largest hotel in the world, the "Astoria."

CHAMBERS BROTHERS COMPANY, of Philadelphia, report decided improvement in inquiries for brickmaking machinery within the past two months, and have booked an order for machinery to go to South America, and have recently shipped another of their well-known automatic end-cut brickmaking machines to Europe. They are very much gratified with the interest taken in their new steam-power repress for plastic brick, and have received two orders for this press within a few weeks. It is illustrated on page xl of this issue, and weighs about 14,000 lbs.

THE PHILADELPHIA AND BOSTON FACE BRICK COMPANY report that their business is better than it has been for years past. They are running a very large force of men at their works in Charlestown, and say that their brick mantel business the last week in August was the largest in the history of the company. In all their departments the demand is so great for their goods (which are sent to all parts, not only of the United States, but of the world) that they may have to run extra time to fill their orders.

THE following is a list of new buildings, for which the White Brick and Terra-Cotta Company have furnished the architectural terra-cotta: —

TERRA-COTTA LION'S HEAD IN CROWN MOLD OF CORNICE OVER 12TH STORY ST. JAMES BUILDING, BROADWAY, NEW YORK CITY.
Bruce Price, Architect.
Executed by the Perth Amboy Terra-Cotta Company.

Hospital for Crippled and Ruptured, Lexington Avenue and 43d Street, New York; architect, C. C. Haight. Addition to Normal School, Jamaica, L. I.; architect, I. G. Perry. Mercantile Building, 134–138 Mott Street, New York; De Lemos & Codres, architects; "The Washington Irving" apartment house, 112th Street, near 7th Avenue; architect, George Keister. Hudson Building, 32–34 Barry Street, New York, Clinton & Russell and A. F. Leicht, architects, Mercantile Building, 10th Street and University Place, New York; architect, W. J. Dilthey. Mercantile Building, 7 Great Jones Street; architect, L. Korn. Memorial Chapel, Wellesley College, Wellesley, Mass.; architects, Heins & La Farge.

CENTRAL MOTIVE, DENTAL HALL, UNIVERSITY OF PENNSYLVANIA.
Edgar V. Seeler, Architect.
Executed in Terra-Cotta by the Conkling, Armstrong Terra-Cotta Company.

FISKE, HOMES & CO. report an active demand for their light brick specialties, sales for August being largely in excess of previous month.

Amongst principal orders booked are: —

Extension of Hotel Reynolds, Boylston Street, Albert Geiger, Esq., owner, Arthur H. Vinal architect; the Home for Incurables, Cambridge, Mass.,

W. H. and J. A. McGinty architects; United States Post-Office, Lynn, Mass.; chapel and office, Mt. Auburn Cemetery, W. A. Sears architect; Mercantile Building, Merrimac Street, Boston, T. E. Clark

PORTION OF PARAPET RAIL, C. WEYAND BREWERY, BUFFALO, N. Y.
Geo. J. Metzger, Architect.
Executed in terra-cotta by the Northwestern Terra-Cotta Company.

architect; Mercantile Building, Main Street, Cambridge, Mass.; Twombly Block, South Framingham, Mass., C. E. Barnes & Co. architects; Legal Chambers, Spring and Poplar Streets, Boston, F. A. Norcross architect; Slocum Block, New Bedford, Mass., Nat C. Smith architect; extension of Parker House, New Bedford, Mass., Nat C. Smith architect; private residence, Cambridge, Mass., H. Langford Warren architect; business block, Lawrence, Mass.; Galvin's Block, Exeter and Boylston Streets, Boston; residence, New Haven, Conn.; barn for Springfield Street Railway Company, Springfield, Mass., brick and terra-cotta, Gardner, Pyne & Gardner architects; Tyler Block, New Haven, Conn.; Besse Block, Springfield, Mass.; together with about fifty apartment houses, business blocks, and private residences in Boston and immediate vicinity, taking approximately one million bricks.

We are in receipt of some very handsome blotters from the Clinton Wire Cloth Company, of Clinton, Mass.

It is the intention of the company to mail a new blotter each month to all parties interested in the use of wire cloth for building or other purposes. Any parties desiring to receive them regularly may have their names put on the list by sending their address to the Clinton Wire Cloth Company, Clinton, Mass.

For Sale.

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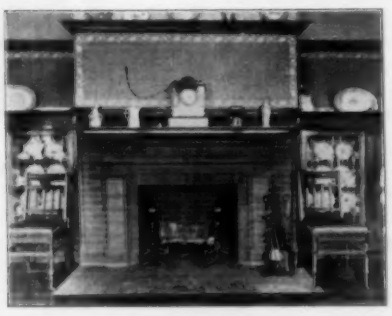

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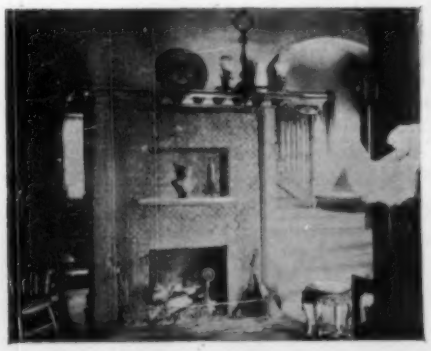

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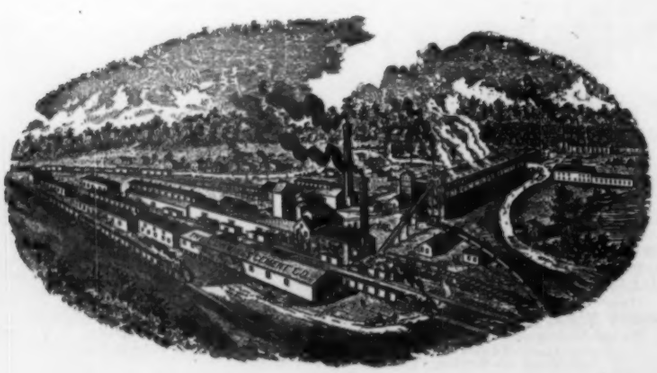

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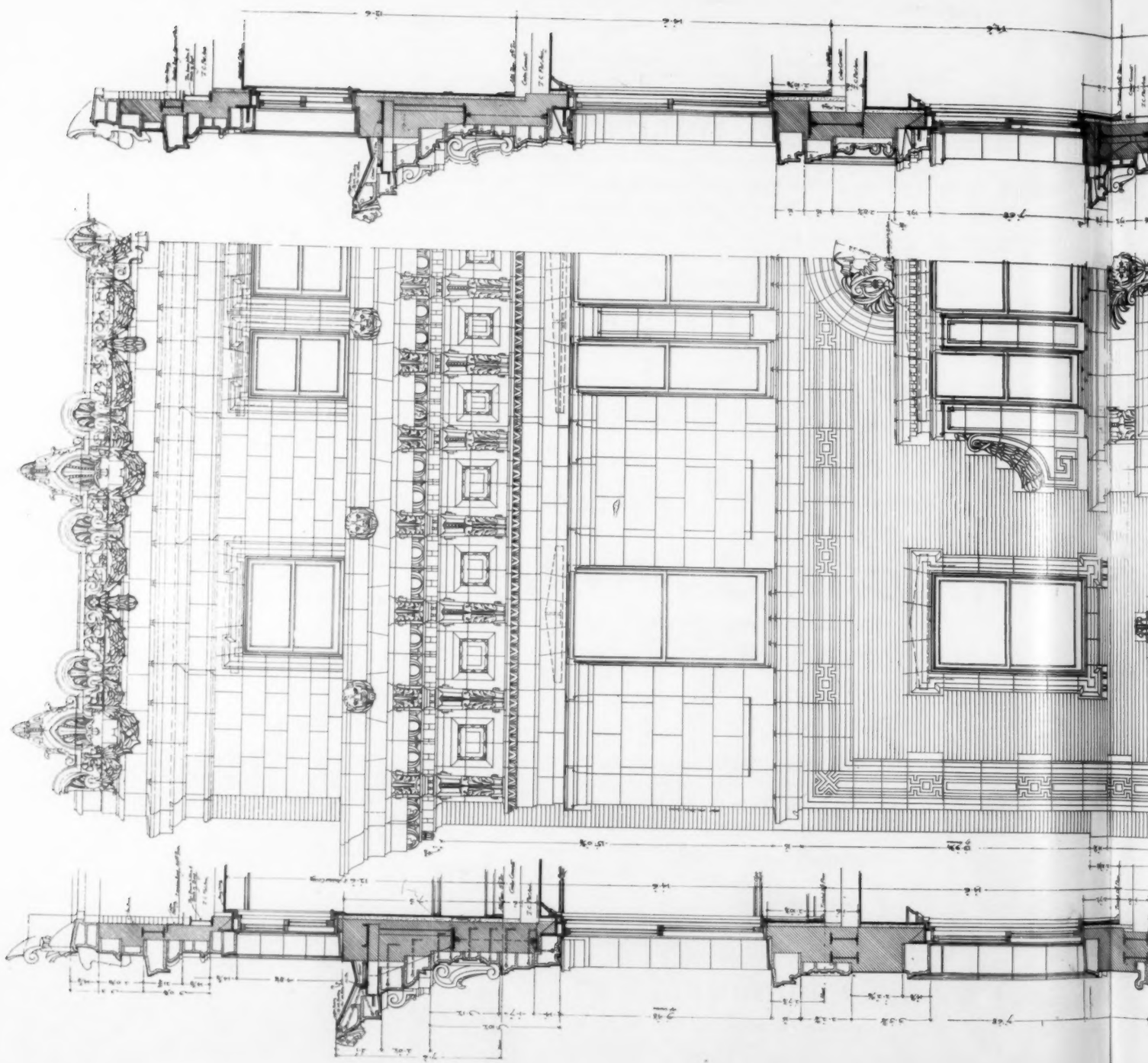

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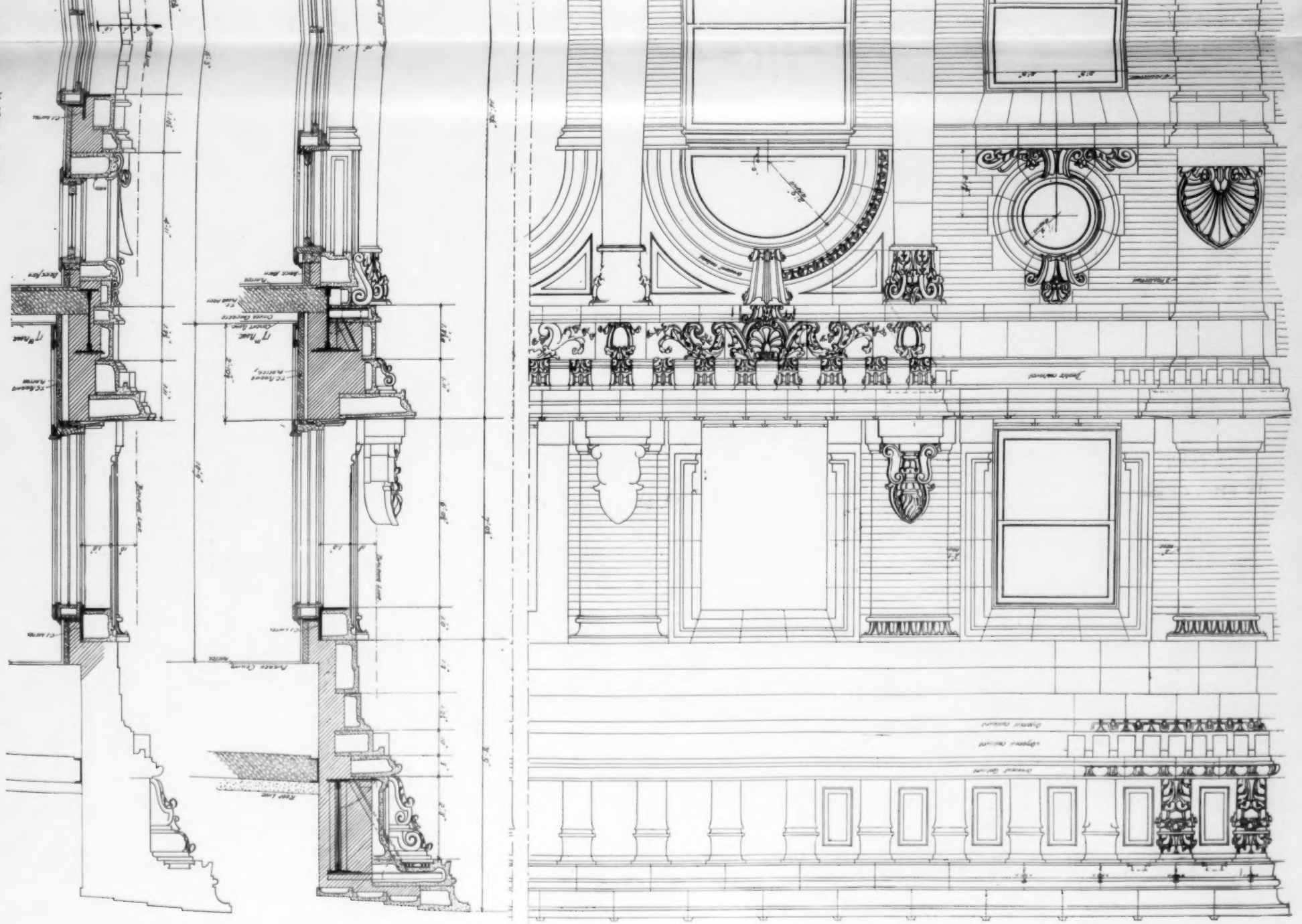
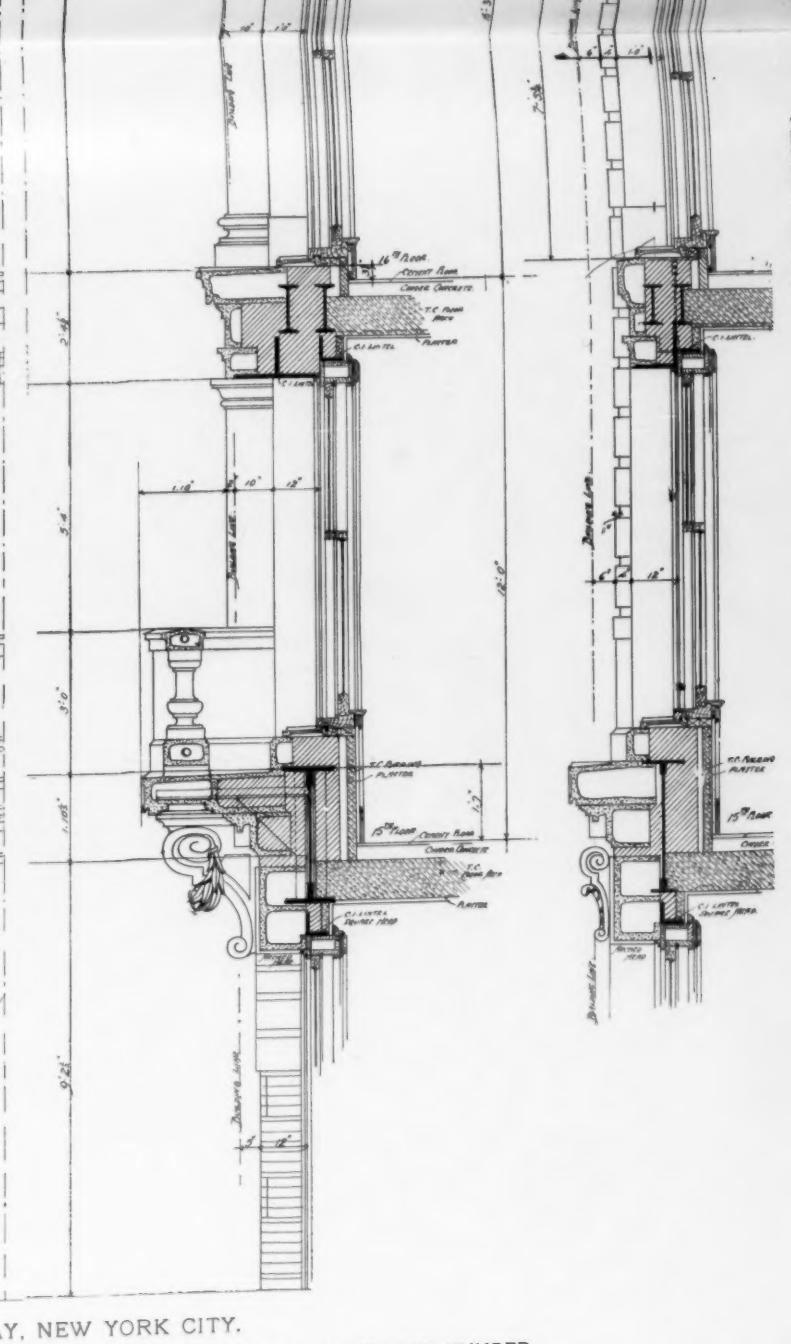
DETAILS OF TERRA-COTTA WORK, ETC., UPPER STORIES. ILLUSTRATION OF PERSPECTIVE SHOWN IN LETTER-PRESS PORTION OF THIS NUMBER.
GEO. EDWARD HARDING & GOOCH, ARCHITECTS.





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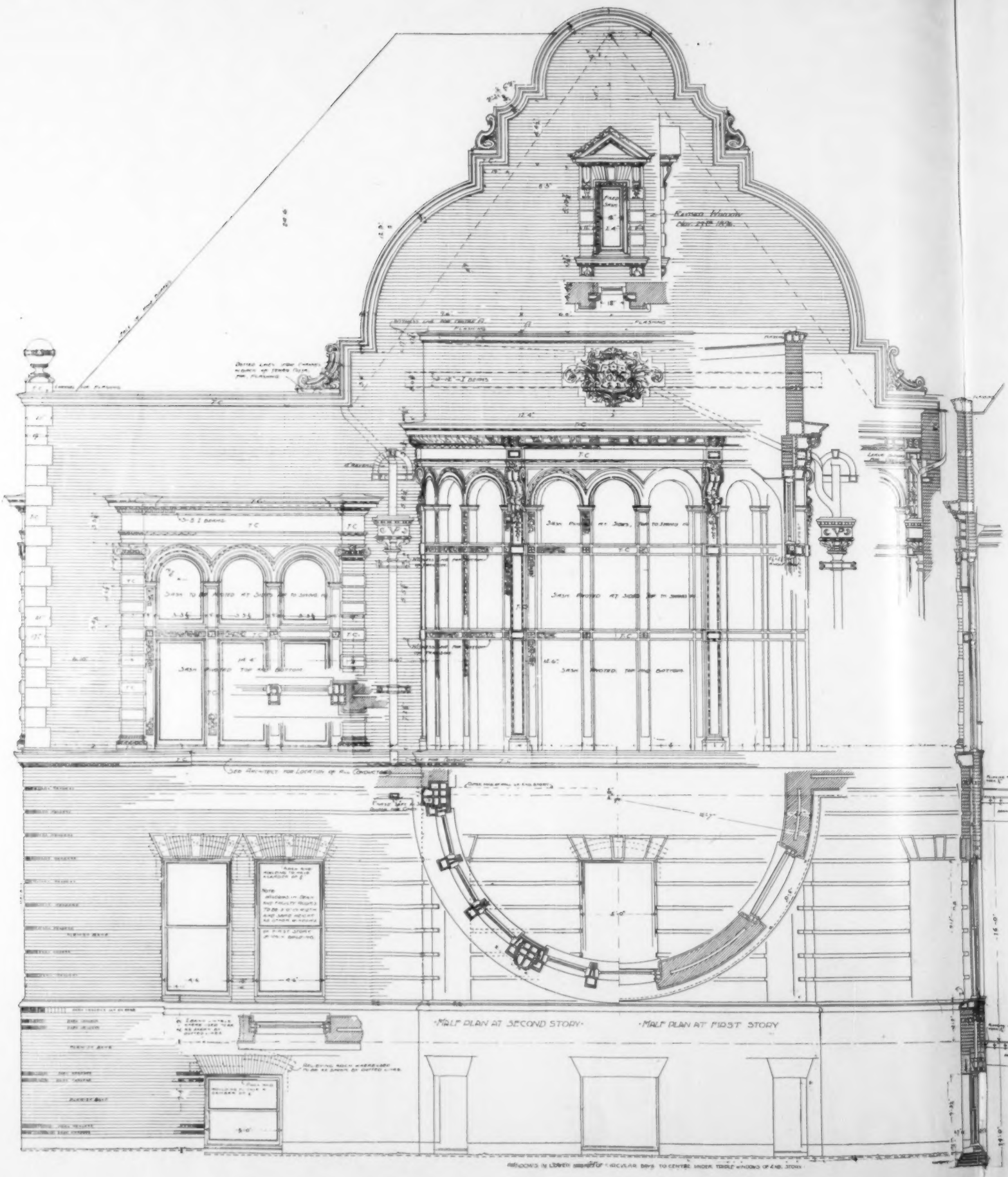

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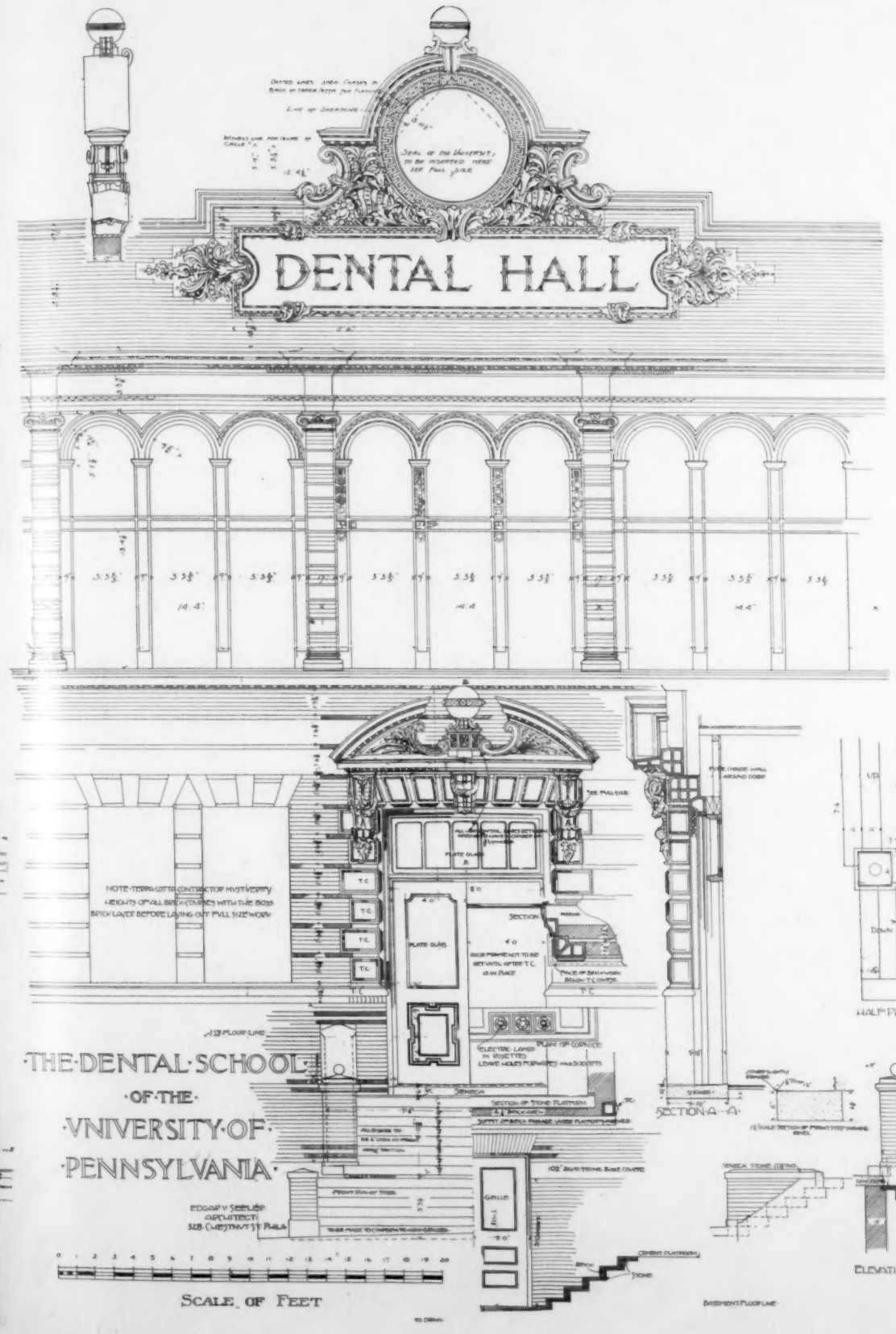

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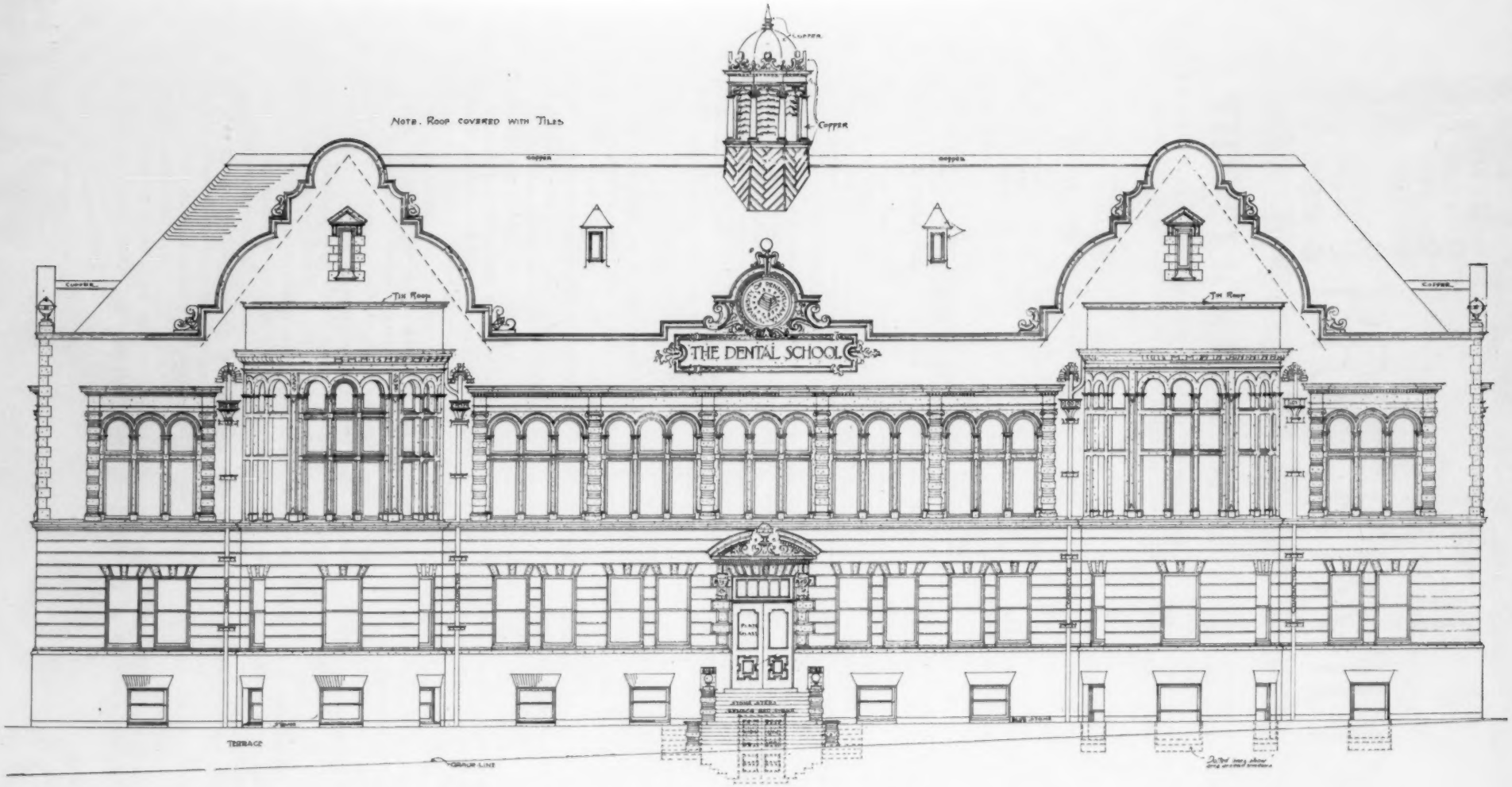

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